CDC 00594

The Transactor

The Tech/News Journal For Commodore Computers

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The Tech/News Journal For Commodore Computers

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Richard Evers

Technical Editor
Chris Zamara

Art Director
John Mostacci

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Charles Whittern

Production
Attic Typesetting Ltd.

Printing
Printed in Canada by
MacLean Hunter Printing

The Transactor is published bi-monthly by Transactor Publishing Inc., 500 Steeles Avenue, Milton, Ontario, L9T 3P7. Canadian Second Class mail registration number **6342.** USPS **725-050,** Second Class postage paid at Buffalo, NY, for U.S. subscribers. U.S. Postmasters: send address changes to The Transactor, 277 Linwood Avenue, Buffalo, NY, 14209 **ISSN# 0827-2530.**

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Subscriptions:
Canada $15 Cdn. U.S.A. $15 US. All other $21 US.
Air Mail (Overseas only) $40 US. ($4.15 postage/issue)

Send all subscriptions to: The Transactor, Subscriptions Department, 500 Steeles Avenue, Milton, Ontario, Canada, L9T 3P7, 416 878 8438. Note: Subscriptions are handled at this address ONLY. Subscriptions sent to our Buffalo address (above) will be forwarded to Milton HQ. For best results, use postage paid card at center of magazine.

Program Listings In The Transactor

All programs listed in The Transactor will appear as they would on your screen in Upper/Lower case mode. To clarify two potential character mix-ups, zeroes will appear as '0' and the letter "o" will of course be in lower case. Secondly, the lower case L ('l') has a flat top as opposed to the number 1 which has an angled top.

Many programs will contain reverse video characters that represent cursor movements, colours, or function keys. These will also be shown exactly as they would appear on your screen, but they're listed here for reference. Also remember: CTRL-q within quotes is identical to a Cursor Down, et al.

Occasionally programs will contain lines that show consecutive spaces. Often the number of spaces you insert will not be critical to correct operation of the program. When it is, the required number of spaces will be shown. For example:

print " flush right " – would be shown as – print "[10 spaces]flush right "

Cursor Characters For PET / CBM / VIC / 64

Down	– q	Insert	–
Up	–	Delete	– t
Right	–	Clear Scrn	–
Left	– [Lft]	Home	– s
RVS	– r	STOP	– c
RVS Off	–		

Colour Characters For VIC / 64

Black	– P	Orange	– A
White	– e	Brown	– U
Red	–	Lt. Red	– V
Cyan	– [Cyn]	Grey 1	– W
Purple	– [Pur]	Grey 2	– X
Green	–	Lt. Green	– Y
Blue	–	Lt. Blue	– Z
Yellow	– [Yel]	Grey 3	– [Gr3]

Function Keys For VIC / 64

F1 – E	F5 – G
F2 – I	F6 – K
F3 – F	F7 – H
F4 – J	F8 – L

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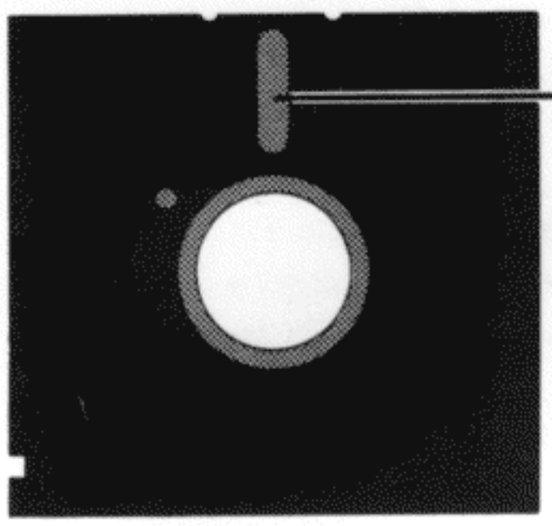

Start Address

Of Mice And Metaphors

We may be at a historical moment in the use of personal computers. Operating systems using mice, icons, desk-top metaphors, and windows seem to be catching on and only time will tell if they become the usual way of doing things in the future. We've seen it on Apple's Lisa and Macintosh, then the Atari 520ST, and now on the outstanding Amiga from Commodore. But is this a go-with-the-latest-computing-trend marketing effort, or a real step towards that difficult-to-measure goal of increased productivity?

Take the Icon. Please. Seriously, the concept of having a little picture on the screen instead of a word to represent a function is a good one, but can also be confusing. It is said that a picture is worth a thousand words, but that can be a problem when you want just one specific one. Does a jagged line icon in a graphics program indicate line drawing, graph plotting, straightening curves, or what? I suppose you could point to it to find out, but it would be nice to glance at the screen and know your options; key words like 'GRAPH', 'LINES', 'STRAIGHTEN', etc. would do the job nicely. Likewise, the word CUT may be clearer than a hard-to-visualize (especially on a low-res screen) pair of scissors. Words are more universal than pictures in the sense that not everyone interprets images in the same way; if you want proof, try playing "what do you see in the clouds?" with ten people. Today it may sound like a step backwards, but I often prefer good old-fashioned words over undecipherable symbols. Didn't mankind discover that thousands of years ago?

Throughout Canada, many of our road signs have gone symbolic. When you enter crown land, you may be greeted by a sign covered in little stick figures in various positions indicating the intended purpose of the land. If instead, the sign read, "hunting, fishing, camping, sightseeing. . ." perhaps it wouldn't be necessary to pull over, get out of the car and muse, "Hmmm. . . what's that guy doing? Is he using a shotgun or a walking stick?. . .". Similarly, the words SLOW and FAST on a piece of machinery are no doubt more easily understood than a picture of a tortoise and a hare, even if it means learning two words of English.

Which brings up one of the advantages of icons when used properly: they are international. Stress *when used properly*, because the temptation for software developers to transmit messages in a cute way through the icon is sometimes too great to resist. For example, The Amiga comes with a 'Software Demo Package' giving a sneak preview at some excellent-looking upcoming software from Electronic Arts. As the demo cycles, you can stop it at any time by pressing the right mouse button, and while the demo is stopped, an icon containing two - what are they? - um, pawprints appears on the screen. Get it? Paws - Pause! Ha ha. Cute and clever, and everyone gets a laugh when they figure it out or someone explains it to them, but that's the problem: are we now doomed to deciphering some unknown programmer's bad puns when all we want to do is use a piece of software? At the risk of sounding like a spoilsport, there's nothing wrong with a bit of fun, but not at the expense of clarity and ease-of-use.

Enough about Icons; what about software metaphors themselves? The simulated desktop using 'windows' makes it easier for the non-computer type to get things done with a computer, because it relates to something he's familiar with. In a way, that's a big step forward because we are teaching machines to adapt to man rather than man to adapt to the machines. As a result, computer operation is becoming more intuitive rather than more complex. On the other hand, forcing a new office tool to behave like an old one in the interest of compatibility can be restrictive if the new tool is significantly more powerful and flexible. The ideal metaphor would probably mimic the human mind, not a human working environment, but that kind of software is no doubt many years off. Overall, the same rule applies to software metaphors as to icons: they can be good when used reasonably, but taken too far or used out of context, can be a hindrance.

I do like the windows themselves. At least, I like the way windows are handled on the Amiga – I haven't used any other system long enough to decide. True, you can lose track of what's behind what, and a lot of moving and clicking gets done, but it seems to be the best solution to keeping track of multiple tasks around. Still in its infancy, the windowed environment will probably get even more powerful and automated, and I'll like it even more.

What about the mouse? In my opinion, fun to use and precise, but isn't there a better way to point at something on the screen without clearing a space on your desk and *still* knocking over a cup of coffee once in a while? These things need S P A C E to be used effectively, and that's something that there can be a real shortage of – at least in my office there is. There's always the trackball, but it's not as easy to CLICK, since your hand doesn't stay in one place. The alternative, of course, is the keyboard, but I won't say I prefer it to the mouse because I'm still having too much fun with the little plastic rodent.

So, at the start of this new age of computing, does it look like utopia ahead? Will any non-computerist businessman or housewife be able to buy a computer and a bunch of software, and do all of the things that the ads have been telling them they could do? It seems that the new operating systems can deliver on that promise, but only if software developers use them in the spirit in which they were intended. When designed properly, a Mouse/Icon-driven Windowed environment can be easy to use and enormously productive. When used as a gimmick, or when flash prevails over substance, it can be an enigma to the user.

Chris Zamara, Technical Editor

Using "VERIFIZER"

The Transactor's Foolproof Program Entry Method

VERIFIZER should be run before typing in any long program from the pages of The Transactor. It will let you check your work line by line as you enter the program, and catch frustrating typing errors. The VERIFIZER concept works by displaying a two–letter code for each program line which you can check against the corresponding code in the program listing.

There are two versions of VERIFIZER on this page; one is for the PET, the other for the VIC or 64. Enter the applicable program and RUN it. If you get the message, "***** data error *****", re–check the program and keep trying until all goes well. You should SAVE the program, since you'll want to use it every time you enter one of our programs. Once you've RUN the loader, remember to enter NEW to purge BASIC text space. Then turn VERIFIZER on with:

SYS 828 to enable the C64/VIC version (turn it off with SYS 831)
or SYS 634 to enable the PET version (turn it off with SYS 637)

Once VERIFIZER is on, every time you press RETURN on a program line a two-letter report code will appear on the top left of the screen in reverse field. Note that these letters are in uppercase and will appear as graphics characters unless you are in upper/lowercase mode (press shift/Commodore on C64/VIC).

Note: If a report code is missing it means we've editted that line at the last minute which changes the report code. However, this will only happen occasionally and only on REM statements.

With VERIFIZER on, just enter the program from the magazine normally, checking each report code after you press RETURN on a line. If the code doesn't match up with the letters printed in the box beside the listing, you can re–check and correct the line, then try again. If you wish, you can LIST a range of lines, then type RETURN over each in succession while checking the report codes as they appear. Once the program has been properly entered, be sure to turn VERIFIZER off with the SYS indicated above before you do anything else.

VERIFIZER will catch transposition errors (eg. POKE 52381,0 instead of POKE 53281,0), but ignores spaces, so you may add or omit spaces from the listed program at will (providing you don't split up keywords!). Standard keyword abbreviations (like nE instead of next) will not affect the VERIFIZER report code.

Technical info: VERIFIZER resides in the cassette buffer, so if you're using a datasette be aware that tape operations can be dangerous to its health. As far as compatibility with other utilities goes, VERIFIZER shouldn't cause any problems since it works through the BASIC warm–start link and jumps to the original destination of the link after it's finished. When disabled, it restores the link to its original contents.

Listing 1a: VERIFIZER for C64 and VIC–20

```
KE  10 rem* data loader for "verifizer" *
JF  15 rem vic/64 version
LI  20 cs=0
BE  30 for i=828 to 958:read a:poke i,a
DH  40 cs=cs+a:next i
GK  50 :
FH  60 if cs<>14755 then print"***** data error *****":end
KP  70 rem sys 828
AF  80 end
IN  100 :
EC  1000 data 76, 74,   3,165,251,141,  2,  3,165
EP  1010 data 252,141,  3,  3, 96,173,  3,  3,201
OC  1020 data   3,240, 17,133,252,173,  2,  3,133
MN  1030 data 251,169, 99,141,  2,  3,169,  3,141
MG  1040 data   3,  3, 96,173,254,  1,133, 89,162
DM  1050 data   0,160,  0,189,  0,  2,240, 22,201
CA  1060 data  32,240, 15,133, 91,200,152, 41,  3
NG  1070 data 133, 90, 32,183,  3,198, 90, 16,249
OK  1080 data 232,208,229, 56, 32,240,255,169, 19
AN  1090 data  32,210,255,169, 18, 32,210,255,165
GH  1100 data  89, 41, 15, 24,105, 97, 32,210,255
JC  1110 data 165, 89, 74, 74, 74, 74, 24,105, 97
EP  1120 data  32,210,255,169,146, 32,210,255, 24
MH  1130 data  32,240,255,108,251,  0,165, 91, 24
BH  1140 data 101, 89,133, 89, 96
```

Listing 1b: PET/CBM VERIFIZER (BASIC 2.0 or 4.0)

```
CI  10 rem* data loader for "verifizer 4.0" *
CF  15 rem pet version
LI  20 cs=0
HC  30 for i=634 to 754:read a:poke i,a
DH  40 cs=cs+a:next i
GK  50 :
OG  60 if cs<>15580 then print"***** data error *****":end
JO  70 rem sys 634
AF  80 end
IN  100 :
ON  1000 data 76,138,  2,120,173,163,  2,133,144
IB  1010 data 173,164,  2,133,145, 88, 96,120,165
CK  1020 data 145,201,  2,240, 16,141,164,  2,165
EB  1030 data 144,141,163,  2,169,165,133,144,169
HE  1040 data   2,133,145, 88, 96, 85,228,165,217
OI  1050 data 201, 13,208, 62,165,167,208, 58,173
JB  1060 data 254,  1,133,251,162,  0,134,253,189
PA  1070 data   0,  2,168,201, 32,240, 15,230,253
HE  1080 data 165,253, 41,  3,133,254, 32,236,  2
EL  1090 data 198,254, 16,249,232,152,208,229,165
LA  1100 data 251, 41, 15, 24,105,193,141,  0,128
KI  1110 data 165,251, 74, 74, 74, 74, 24,105,193
EB  1120 data 141,  1,128,108,163,  2,152, 24,101
DM  1130 data 251,133,251, 96
```

Bits and Pieces

Got an interesting programming tip, short routine, or an unknown bit of Commodore trivia? Send it in – if we use it in the Bits & Pieces column, we'll credit you in the column and send you a free one–year's subscription to The Transactor

C–64 Input Routine With Screen Editing!

Dale Lambert, Tupelo, MS

This little INPUT substitute allows any characters to be entered and also allows full screen editing. It uses the input routine that BASIC uses in direct mode.

```
1 sys42336:forb=512to592:ifpeek(b)<>0thennext
2 in$=" ":poke peek(71)+256*peek(72)+1,0
  :poke peek(71)+256*peek(72)+2,2
3 pokepeek(71)+256*peek(72),b-512
  :in$=mid$(in$,1)
```

Quick Screen Code to ASCII Conversion

Dale Lambert

This line will convert screen code (in the variable S) to ASCII:

```
a=(s and 127)or((s and 64)*2)or((64-s and 32)*2)
```

C–64/VIC20 Mini–Datafier

Dale Lambert

This program will quickly and easily make DATA statements for a machine–language program.

All you have to do is put the starting address of the code in variable S, put the end address in E, put the sttarting line number of the DATA statements in Z, and the amount to increment the DATA line numbers by in variable I. For example:

```
1 s=49152(start):e=50000(end):z=1000(line #):i=10(incr)
```

And here's our program:

```
1 s=49152:e=49400:z=1000:i=10
2 print" Sqq "z" data ";: if s>e then end
3 k=s+6: if k>e then k=e
4 for s=s to k: print mid$(str$(peek(s)),2)" , ";: next
  : print chr$(157);chr$(32) :rem 1 left, 1 spc
5 print" s= "s" :e= "e" :z= "z+i" :i= "i" :goto2 s ";
  :poke631,13:poke632,13:poke198,2:end
```

Dale's Dazzler

Try this on the 64:

```
1 a=192:b=200:c=53270:fori=1to1000step.001
  :pokec,a:pokec,b:next
```

Commodore 64 Meets The Alien From The Cheap Sci–Fi Movie

Giuseppe Amato

Give this a listen, Earthlings:

```
1 s=54272:a=peek(162)and199:pokes+24,15
  :pokes+6,90:pokes+4,21:pokes+1,a
2 pokes+15,abs(99-a):goto1
```

VERIFIZER For Tape Users

Tom Potts, Rowley, MA

The following modifications to the Verifizer loader (see the VERIFIZER page in this issue) will allow VIC–20 and C–64 owners with Datasettes to use the verifizer directly (without the loader) and just SYS to activate it.

After running the new loader, you'll have a special copy of the verifizer program which can be loaded from tape without disrupting the program in memory.

Just run the program below, pressing PLAY and RECORD when prompted to do so (use a rewound tape for easy future access). To use the special verifizer that has just been created, first load the program you wish to verify or review into your computer from either tape or disk. Next insert the special program tape created above and be sure that it is rewound, then enter in direct mode: OPEN1:CLOSE1. Press PLAY when prompted by the computer, and wait while the special verifizer loads into the tape buffer. Once it has loaded, the screen will show FOUND VERIFIZER.SYS850. To activate VERIFIZER, enter SYS 850 (not the 828 as in the original program). To de–activate, use SYS 853. These moves in the SYS addresses were required because of the method used to store and retreive the program in the tape buffer.

If you are going to use your tape recorder to SAVE a program, you must turn off VERIFIZER first (SYS 853) since VERIFIZER moves some of the internal pointers used during a SAVE operation. Attempting a SAVE without turning off VERIFIZER first will usually result in a crash.

If you wish to use VERIFIZER again after using the tape, you'll have to reload it with the OPEN1:CLOSE1 commands.

Make the following additions and changes to the present VERIFIZER loader listed in the magazine on page 4.

```
      Line:
 NB   30    for i=850 to 980: read a: poke i,a
 AL   60    if cs<>14821 then print " *****data error***** "
            : end
 IB   70    rem sys850 on, sys853 off
 --   80    delete line
 --   100   delete line
 OC   1000  data  76,  96,   3, 165, 251, 141,   2,   3, 165
 MO   1030  data 251, 169, 121, 141,   2,   3, 169,   3, 141
 EG   1070  data 133,  90,  32, 205,   3, 198,  90,  16, 247
 BD   2000  a$ = " verifizer.sys850[space] "
 KH   2010  for i=850 to 980
 GL   2020  a$ = a$ + chr$(peek(i)):next
 DC   2030  open 1,1,1,a$: close 1
 IP   2040  end
```

Improved 1541 Head–Cleaning Program — **David Peterson, Irvine, CA**

Volume 6 Issue contained a program by Peter Boisvert which turned the 1541's motor on for 60 seconds to allow cleaning the head using a cleaning disk. This prompted David Peterson to write in with the following improvement. It turns the motor on, then steps the head slowly along the surface of the disk to utilize the entire cleaning surface. David Peterson explains how it works:

After turning on the drive motor, the program peeks location $24 in drive RAM. This location contains the track number that the read/write head is currently at. After finding the head, the program steps it quickly to track 1, then slowly across the disk to track 35. Movement of the head is controlled by bits 0 and 1 of location $1C00 in drive RAM. After peeking $1C00, the head is moved outward to track one by cycling bits 0 and 1 of $1C00. To move the head outward the low bits are decremented (say 01 to 00 to 11 to 10 to 01 etc.). To move the head inward to track 35 the two low bits are cyclically incremented. The head is stepped twice for every track, since the stepper motor moves the head in 1/2 track steps. The NEW at the end of the program is not an attempt at program protection, it's there as drive protection. This direct method of stepping the head does not update location $24. If the program was immediately rerun, the drive head could end up being stepped to track 35 or to bump up against the stop at track 0. Therefore use the loop in line 280 to control how long the process takes.

Here's the new cleaning program; make sure you save it before running!

```
 LM  100 rem* improved 1541 head cleaning prg *
 LD  110 print " S insert cleaning disk and hit return "
 NI  120 geta$:ifa$<>chr$(13)then120
 AL  130 open 15,8,15:print#15, " m-e " chr$(126)chr$(249)
 EE  140 rem locate head
 HP  150 print#15, " m-r " chr$(24)chr$(0)
 JD  160 get#15,a$:x = asc(a$ + chr$(0))
 EC  170 print " drive head at track # " x
 IA  180 rem read $1c00
 PH  190 print#15, " m-r " chr$(0)chr$(28)
 EL  200 get#15,sc$:sc = asc(sc$ + chr$(0))
 FO  210 rem select bits 0 and 1
 GN  220 bt = sc and 3
 CD  230 rem # tracks to 1
 ID  240 sp = 2*(x-1)
 MH  250 rem move head to track 1
 BL  260 print " q stepping to track #1 "
 FJ  270 for y = 1 to sp
 EF  280 bt = bt-1:bt = bt and 3
 KO  290 s = (sc and 252)or bt
 IH  300 print#15, " m-w " chr$(0)chr$(28)chr$(1)chr$(s)
 FE  310 next y
 HL  320 rem step out to 35
 IM  330 print " stepping out to track # 35. . . "
 FB  340 print#15, " m-r " chr$(0)chr$(28)
 CH  350 get#15,a$:sc = asc(a$ + chr$(0))
 CG  360 bt = sc and 3
 CE  370 for y = 1 to 68
 GF  380 print " qq track # " int(y/2 + 1)
 AF  390 print " QQQQ "
 JM  400 bt = bt + 1: bt = bt and 3
 CG  410 s = (sc and 252) or bt
 AP  420 print#15, " m-w " chr$(0)chr$(28)chr$(1)chr$(s)
 FF  430 ford = 1to220:nextd
 HM  440 next y
 FI  450 print#15, " m-e " chr$(232)chr$(249):close15
 HF  460 new: rem to prevent re-running without a normal
         disk operation first
```

PRINT AT Update — **Stephen Gast, Champaigne. IL**

In the Bits and Pieces column of Volume 6, Issue 3, a C64/VIC20 PRINT AT command was suggested:

```
poke 781,row: poke 782,col: sys 65520: print " message "
```

The above method utilizes the documented KERNAL routine PLOT. The general technique is a useful one but can be unreliable when accessed through the KERNAL jump table at 65520 ($FFF0).

If the carry flag is set, the routine will GET the current cursor position! Not exactly what we had in mind. To correct this the current row and column coordinates should still be placed directly into the register storage area in 781 ($030D9 and 782 ($030E). Then simply bypass the logic of the cursor get/set routine at $E50A and SYS directly to 58636 ($E50C). In both the VIC 20 and the Commodore 64 this will work:

```
poke 781,row: poke 782,col: sys58636: print " message "
```

Now let's talk a little about some other things you can do on a 64. First, the following line is an alternative to the above example:

```
poke 211,col: poke 214,row: sys 58640: print " message "
```

This enters the plot routine a little later and avoids two steps (big deal at ML speeds). But secondly, if you do this a lot in a program, here is a neat 25 byte machine language routine that makes life a little simpler:

```
0806 20 fd  ae jsr  $aefd  ;scan past the comma
0809 20 9e b7 jsr  $b79e ;put row in .X
080c 86 d6     stx  $d6    ;store row in TBLX (current cursor
                            line #)
080e 20 f1  b7 jsr  $b7f1  ;scan past comma and put column
                            in .X
0811 86 d3     stx  $d3    ;put column in PNTR (current cur-
                            sor column #)
0813 4c 10 e5 jmp $e510 ;set the cursor
```

The following short BASIC program will place this routine in a REM statement:

```
10 rem xxxxxxxxxxxxxxxxxxxxxxxxx   [25 x's]
20 for x=2054 to 2069: read y: poke x,y: next x
30 data 32,253,174,32,158,183,134,214,32,241,183,
        134,211,76,16,229
```

Be sure 25 x's follow the REM in line 10. After typing the program in, run it and delete lines 20 and 30. Save the remaining line 10 to disk as a program and simply load and use it as the first line of any program in which you want to easily be able to position the cursor. The syntax is now simplified to:

```
SYS 2054,row#,column#: PRINT " message "
```

C–128 Bits

Randy Linden, Willowdale, Ont.

Here are a couple of "C64 mode" peculiarities: The CAPS–lock key can be read in C64 mode, and the most interesting feature – **2Mhz. clock speed is available in C64 mode!**

The CAPS–lock key can be checked with bit 6 in memory location $0001 of the C64 side. If bit 6 is set, then the CAPS–lock key is NOT pressed; if it is zero, the key is pressed. Example:

```
if (peek(1)and64)=0 then print " caps lock on " .
```

Bit 0 in memory location $D030 controls the speed of the microprocessor. In C64 mode, this bit is normally zero, running the system at 1Mhz. If you set this bit, the computer will run at 2Mhz! Example:

```
poke 53296,peek(53296)or1
```

to set 2Mhz mode. The catch is that in C64 mode, the VIC video chip cannot operate at warp 2 and is disabled when 2Mhz mode is set, displaying a blank screen. However, for operations which do not need the video screen, such as assembling programs in machine language or sorting lists, the screen can be turned off for a speed increase of 100%!

For a simple demonstration, try the following program in C64 mode.

```
10 print " C64 at 2Mhz – Randy Linden "
20 print " Caps–lock down for 2Mhz, "
30 print " Caps–lock up for 1Mhz. "
40 for d=0 to 36
50 read rl: poke 52992+d,rl: ck=ck+rl: next d
60 if ck<>3571 then print " ?Data error! " : stop
70 sys 52992: print " Now installed. " : end
100 data 169, 11, 141, 20, 3, 169, 207, 141,
         21, 3, 96, 165, 1, 41, 64, 73, 64, 10, 10, 42
110 data 141, 37, 207, 173, 48, 208, 41, 252,
         13, 37, 207, 141, 48, 208, 76, 49, 234
```

The code resides at $CF00–$CF25 in memory on the Commodore 64. When run, it changes the IRQ vector to point to a routine at $CF0B which scans the CAPS–lock key and turns on 1Mhz mode if it is up, or 2Mhz mode if it is down.

More B128 Bits From Liz Deal

1. COLLECT is a variant of the DOS native command VALIDATE (V). The B machine actually *thinks* at the time of validation. Example: if you've just written a file of 6 blocks but didn't close it, the directory shows 6 blocks and a *. At this point "V" would get rid of the file, but COLLECT closes it. Not bad.

2. An important control byte exists at $258: Logical file number of CMD file. It's used for printing integers (line numbers) on a CMD device. It permits sending disk directories directly to a CMD device, so:

```
OPEN 4,4:CMD 4: CATALOG
```

Does just that to the printer. Neat.

3. everybody knows that LIST is a harmless command. . .or is it? Try it on the B128 with a program from the plus 4 containing the keyword SCALE (that's token number $E9). TThe machine either crashes dead or ends up in the machine language monitor. And if that weren't enough, the program you just tried to list NEWs itself. Brilliant.

4. Locations $20–$21 are important in working dynamic strings. They hold temporary pointers to strings. Do not ever use them for anything else if you do 't want your strings mangled, FRE crashing, and so on.

5. New center of B information, besides TPUG, is now:

Norman Deltzke
4102 N. Odell
Norridge, IL
60634
– Send 2 SASEs.

Un–Scratcher For Commodore Drives

Oops! Just scratch the wrong file by mistake and wipe out 3 hours of work? Don't panic – use the Un–Scratcher. If you haven't done any more saving since the scratch, your old file is still recoverable. The Un–Scratcher program below will ask you the type of drive you have (you may want to hard–code this into the program if you're always using the same drive), and display the filenames of scratched programs one by one, asking if you wish to un–scratch them. It will then write in the new directory information and validate the disk, asking for confirmation before each step. After that your life may continue normally since your precious work has been restored. Even if you have to enter it by hand, this is a routine that can really pay for itself!

```
CN | 100 rem save " 0:un–scratch " ,8: rem ** rte/85
NL | 110 z$ = chr$(0): cr$ = chr$(13): sc = 1: dr = 0
   |     : rem dirsec + drvnum
FI | 120 print " ** disk file un–scratcher ** " cr$ " enter drive type "
LO | 130 print "  a) 1541/2031 " cr$ "  b) 2040/4040 " cr$ "  c) 8050/8250
   | "
FM | 140 input " your choice " ;dt$: if dt$< " a "  or dt$> " c "  then 140
MP | 150 dt = 18: bh = 3: if dt$ = > " b "  then bh = 17
   |     : if dt$ = " c "  then dt = 39
KE | 160 open 15,8,15: open 8,8,8, " #0 "
EN | 170 print#15, " u1: " 8;dr;dt;sc: rem read dir sector
GD | 180 print#15, " m–r " chr$(0)chr$(bh)chr$(2): get#15,nt$,ns$
   |     : rem next trk/sec
MG | 190 flag = 1: for lk = 0 to 7: ps = lk*32
   |     : print#15, " m–r " chr$(2 + ps)chr$(bh)chr$(19)
KD | 200 get#15,sb$,ft$,fs$: if len(sb$) or len(ft$) = 0 then 310
LE | 210 print  " 1st data track " asc(ft$) " sector " asc(fs$ + z$)
BD | 220 print  " filename  " ;: for name = 1 to 16: get#15,n$: print n$;
   |     : next
FF | 230 print#15, " m–r " chr$(30 + ps)chr$(bh)chr$(2): get#15,l$,h$
   |     : rem file size
LE | 240 print: print  " size " asc(l$ + z$) + 256*asc(h$ + z$) " block(s) "
KD | 250 input  " un–scratch (y/n)  " ;us$: if us$<> " y "  then 310
   |     : rem * nope
KN | 260 input  " file type: s, p, u, r  " ;ft$: us = 0
ML | 270 for chk = 1 to 4: if ft$ = mid$( " spur " ,chk,1) then us = chk + 128
OK | 280 next chk: if us = 0 then 260: rem incorrect reply
KM | 290 print#15, " m–w " chr$(2 + ps)chr$(bh)chr$(1)chr$(us)
CH | 300 print  " done !! " : print: flag = 0
KE | 310 next lk
EB | 320 if flag then 350: rem no change in sector
AH | 330 input  " write block to disk (y/n)  " ;yn$: if yn$<> " y "  then 350
MK | 340 print#15, " u2: " 8;dr;dt;sc
PA | 350 dt = asc(nt$ + z$): sc = asc(ns$ + z$): if dt then 170
   |     : rem more to go
NE | 360 if us = 0 then 390: rem nothing to un–scratch
OG | 370 input  " validate the diskette (y/n)  " ;yn$: if yn$<> " y "  then 390
CO | 380 print#15, " v "  + str$(dr): print  " >> validating disk << "
PF | 390 close8: close15: end
```

Hardware Device Number Change for the 2031 Drive

The 2031 single drive can be hard–wired as device number 9 or 10. The number is determined by two diodes on the PC board, CR18 and CR19. Both diodes are normally connected for device number 8; snip one of the leads on CR18 for device 10 or CR19 for device 9.

C64 Doodle Screen

Tom White, Sudbury, ON

If you've ever drawn pictures on the screen with the standard graphics and editor on the C–64, you've probably hit the RETURN key by accident more than once. This results in a READY or ?SYNTAX ERROR message partly wiping out your creation. To counter this menace, simply enter the following before you start your masterpiece:

```
poke 768,123: poke 769,164
```

While in this mode, all of the BASIC commands still work, so take care not to type LIST, RUN or any similar instruction that might ruin your picture. To return the error messages back to normal, type:

```
poke 768,139: poke 769,227
```

1541 Write–Protect Check

Craig McQueen, Guelph, ON

Have you ever wanted a routine to find out if there is a write–protect switch on a disk? All one has to do is read the value of $1C00, bit 4. If the bit is 0, then the write protect is on. Here is a memory–read routine to do the checking for you.

```
5 rem check for write–protect (1541)
10 open 15,8,15
20 print#15, " m–r " chr$(0);chr$(28)
30 get#15,a$: a = asc(a$ + chr$(0))
40 if(a and 16)then 70
70 print " write protect is on! "
60 goto 80
50 print " no write protect "
80 close 15
```

C–64 Memory Fill ROM Routine

Thomas Henry
North Mankato, MN

Thomas Henry writes:

In the Volume 6, Issue 1 Bits & Pieces section, you described the use of the memory transfer subroutine contained within the BASIC ROM. One vital piece of information is missing, though. The memory transfer routine is not "intelligent". Specifically, it fails to work correctly if you attempt to move a block of data in the downward direction AND if the source block overlaps the destination block. In all other cases however, it works just fine.

By the way, the routine has this limitation since it was originally designed to spread apart BASIC lines in memory. The designers apparently never intended for it to be used for any other purpose than making room for new BASIC lines in RAM. Of course, this type of memory transfer will always be occuring in an upward direction (from lower to higher adresses). Now that we know the limitation, however, we hackers can use it for other purposes as well.

Here's a neat trick that actually exploits the shortcomings just mentioned to good advantage. See if you can figure out how it works. (The following addresses are for the C–64; refer to the abovementioned issue for for the corresponding addresses in the PET/CBM and VIC–20.)

THE TASK: We wish to fill a block of RAM with a specific byte. We'll call this a memory fill subroutine. Possible uses include clearing a bit–map screen, setting colour memory to some value, filling a buffer with zeroes, etc.

THE SOLUTION: Suppose the addresses of the start of the block to be filled is START and the last address of the block is END. For example sake, let's imagine we wish to fill this block with zeros. Perform the following steps:

1. *Store a zero (or whatever byte you wish to fill memory with) in location END*
2. *Store address END in location $58 (low byte, high byte).*
3. *Store address END + 1 in location $5A.*
4. *Store address START + 1 in location $5F*
5. *Call subroutine $A3BF (The memory transfer subroutine)*

The block from START to END (regardless of length or location) will be filled with the specified byte – zeros in this case.

One limitation of the block fill routine is that it cannot be accessed from BASIC. Apparently the POKE number or SYS number evaluator plays havoc with locations $58 through $60. However, the routine works just great with machine language and is far simpler to use than "rolling your own".

Relocate!

When creating sprite files, high–res screens, character sets and the like, you don't always know where in memory you'll want to put them. You'd also like those files to be LOADable programs that will go into whatever spot you want. For example, some drawing packages create a high–res screen PRG file on disk that can be LOADed into memory starting at $2000 (8192). If you wish to use that picture but put it at, let's say, $E000, you need to change the picture file's load address on disk. Guess what RELOCATE does? Just tell it your drive type, the filename of the program, and your desired load address, and it changes the load address of the file. Right now. Yes, it *is* fast, because it goes directly into disk memory to change the first two bytes of the file and writes the block back to the disk surface.

```
HD  100 rem save " 0:relocate " ,8
AF  105 rem ** rte/85 – allows quick change of prg load
        address **
CO  110 :
GK  115 z$ = chr$(0)
CK  120 print " drive type: "
GH  125 input " 1)1541/2031, 2)4040, 3)8050/8250 " ;d
        : if d<1 or d>3 then 125
DD  130 if d = 1 then dl = 144: dh = 2: di = 4: dt = 18: bl = 0
        : bh = 3: rem 1541/2031
HC  135 if d = 2 then dl = 150: dh = 67: di = 4: dt = 18: bl = 0
        : bh = 17: rem 2040/4040
OF  140 if d = 3 then dl = 96: dh = 67: di = 8: dt = 39: bl = 0
        : bh = 17: rem 8050/8250
FA  145 :
AJ  150 input " drive #, filename " ;dr,f$
        : f$ = str$(dr) + " : " + f$
HE  155 input " new start address (decimal) " ;sa
        : sh% = sa/256: sl = sa–256*sh%
MP  160 open 15,8,15: open 8,8,8,(f$): get#8,a$
        : if st then close8: stop
FL  165 print#15, " m–r " chr$(dl)chr$(dh): get#15,s$
        : rem sector
IP  170 print#15, " m–r " chr$(dl + di)chr$(dh): get#15,i$
        : rem index
ID  175 s = asc(s$ + z$): i = asc(i$ + z$) + 1
II  180 close 8: open 8,8,8, " #0 "
AH  185 print#15, " u1: " 8;dr;dt;s: rem read in directory
        track/sector
BD  190 print#15, " m–r " chr$(bl + i)chr$(bh)chr$(2)
        : rem get 1st data block ptr
OM  195 get#15,t$,s$: t = asc(t$ + z$): s = asc(s$ + z$)
HF  200 print#15, " u1: " 8;dr;t;s: rem get first data block
DM  205 print#15, " m–w " chr$(bl + 2)chr$(bh)chr$(2)
        chr$(sl)chr$(sh%)
BP  210 print#15, " u2: " 8;dr;t;s: rem write block back
IE  215 close 8: close 15
GE  220 print " ** address changed ** "
BO  225 end
```

Letters

Oops – I Really Blew That One! *Within minutes after the last issue was released, or so it seemed, I ended up on the receiving end of a telephone conversation with Chris Wiesner in Ottawa. The conversation we had made me blush for the first time in years. It seems that in his letter, as we reproduced it in on page 13 of last issue, I really fouled up – twice. The first was to spell his name incorrectly (I before E except after C). The second, and this was pretty awful, was to incorrectly state the telephone number of his Bulletin Board System in Ottawa. Chris, in a blast of ingenuity, was going to contact the people belonging to the number listed, and lend them his answering machine. Can you imagine how rotten it would be to have your phone ring constantly through the night, only to hear a computer screaming at you when you pick it up. Pretty bad. Anyway, sorry Chris, and multiple sorry to the people who belonged to that line. Unlike my 'The Error Of Our Ways: More Often Oops Than Bloops' note from last issue (page 14), of which Chris made sure to mention, we do foul up at times. Below is the proper name and address of Chris's BBS. Ed.*

Chris K. Wiesner
Ottawa Mail Forwarding Service
PO Box 793 Station B
Ottawa, Ontario, K1P–5P8
(613) 830–2823

Pet Accessories: I am the proud owner of a Pet 4032 computer and know several others in my area. Our problem is that there is so little support for the Pet in this area. In fact, nobody has even heard of it! I have need of certain information that I hope you will help me get.

There is an upgrade kit available for the 4032 that is supposed to turn it into an 8032. This is from Comspec Communications Inc. in Toronto, Ontario. Does this really convert the 4032 to an 8032? Also, does this conversion effect the compatibility of the upgraded Pet to existing software? I have also heard of an upgrade kit which adds 64k of memory to the Pet. Where is this available? The Commodore SFD 1001, one megabyte disk drive has recently arrived on the scene unannounced, with little fanfare and even less technical data. It is available from Protecto and Progressive Peripherals. Is this drive software compatible with other Commodore drives? Which ones? What commercial software is available for the Pet in either the 40 or 80 column configurations? What drive is this software designed for?

William Uhler, Richmond, VA

For such a small letter, you sure squeeze in a lot of questions. First, Comspec does sell an update kit for the 4032 to turn it into a true 8032. This update also allows the user to switch back and forth between 4032 and 8032 mode. The trick with this update is that the 4032 has a different keyboard than that of the 8032. To get around this problem, they have written in a control key sequence that allows the user to produce any normal CBM key sequence desired. For an added bonus, quite a few useful but normally unavailable special effects can also be produced. This conversion will not affect the execution of any program written specifically for the 4032 or 8032. The machine will behave exactly as expected. The address for Comspec follows this reply.

In reply to the myth of an extra 64k board for the Pet, it is partially true. First, the Pet has to become an 8032. From that point on the extra 64k is no problem, providing you are willing to shell out $399.00 Cdn. The 64k in question is really the extra board provided with a Commodore 8096 computer, originally designed in Great Britain. The 64k is mapped in a really strange way, though. It overlays screen memory and ROM when enabled, and cannot be used from within Basic. Although this may appear to be a major obstacle in your way, it may not be. A few software packages have been written for the 8096. For example: Wordpro 5+, Paperclip Expanded, Calc Result, and Silicon Office. For a laugh, VisiCalc is also available through the bootleg community for the 8096. Although VisiCorp originally wrote Pet and CBM versions years ago, they had a fallout with Commodore before cutting a version for the 8096. Enter the mysterious hacker. Not only was the package broken (originally ROM protected), but it was also converted over to the 8096. Speaking from personal experience, the package is Ok. Lots of user workspace, and no apparent bugs. I'm sure VisiCorp wasn't too happy with that one.

The SFD 1001, as mentioned last issue, is completely read/write compatible with the now defunct Commodore 8250 drive. With a little bit of effort, and keeping in mind the fact that the SFD 1001 uses both sides of the diskette, the Commodore 8050 is read/write compatible. The 8050 uses only one side of the diskette, 77 tracks – 540k, therefore, when an 8050 diskette is used in an SFD 1001 drive, it will have to be initialized once before access can begin. The first attempt at initialization will always err out, but any access thereafter will be Ok. If put in the reverse situation, SFD 1001 diskette in a 8050 drive, it is completely read/write compatible, providing that no programs to be accessed span onto the opposite side of the diskette. One last note to mention before continuing. The SFD 1001 is a parallel drive, ie. IEEE, therefore anyone wanting to use this beast with their 64 will also need to purchase an IEEE interface.

As a final wrap up of your letter, there is quite a bit of really fine, and not so fine, software available for both the Pet and CBM machines. If you were to prowl around a few of the older user group libraries, you should find plenty of Pet stuff. Contact TPUG and ask if they can help you with this one. As far as commercial software goes, there are quite a few packages available, but locating them may be a bit of a problem now.

Packages such as Superscript, Paperclip, Wordpro, Wordcraft, VisiCalc, Calc Result, The Manager, Jinsam, Ozz, Pal, Power, plus great gobs more, are around. Try finding a copy of the latest 'Commodore Software Encyclopedia', published by Sams Books, and take a peek inside. They not only have listings of recent software for the newer Commodore machines, but also have pages of listings of Pet/CBM software, complete with descriptions, drive and memory requirements, plus distributors names and addresses.

Comspec
153 Bridgeland Avenue, Unit #5
Toronto, Ontario, Canada
M6A-2Y6 (416) 787-0617
Attention: Nick Hooper

A Coded Message:

Dear Sirs

```
PROGRAM LETTER (INPUT, OUTPUT);
TYPE SCALE OF [1. . .10];
     DECUS : FILE OF INFORMATION FOR DIGITAL EQUIPMENT COMPANY
     TRANSACTOR : FILE OF INFORMATION;
CONST VALUE-OF-TRANSACTOR = 10 ON SCALE;
      ISSUE-NOVEMBER = 8 ON SCALE;
VAR COMOL, MACHINE : ABUSED;
      C ; ENJOYABLE;
      GAZETEER OF LANGUAGES : CHAR FROM DECUS;
      LOGO : PLEASE;
      DONE : BOOLEAN;
      DR. ROSS : THANK YOU;
BEGIN;
   DONE:= FALSE
   WHILE NOT DONE DO;
   BEGIN; (*DECUS*)
    READLN(DATE-PUBLICATION);
    WRITELN('Parts of',GAZETEER OF LANGUAGES,' were in',DATE-PUBLICATION);
   END; (*DECUS*)
RESET DECUS;
   BEGIN; (*OTHER STUFF*)
    WRITELN('Where is the Pascal, Ada, Fortran and Promal?');
    READLN(WHERE IS THE BEEF);
    WRITELN('Maybe programmers should learn an other language, ENGLISH');
   END; (*OTHER STUFF*)
 LOGO:= 'Why noy use Pilot?'
   BEGIN; (*NATIONAL COMMODORE LANGUAGE INTEREST GROUP*)
    IF READER = INTERESTED IN OTHER PROGRAMMING LANGUAGES
     THEN BEGIN;
            WRITELN('Contact NCLIG');
            WRITELN('1812 N. I. Street');
            WRITELN('Fremont, NE 68025');
            WRITELN('[402] 721-4346');
          END;
   END;
 DONE:= TRUE;
END.
```

Kent Tegels, Fremont, Nebraska

We get some of the most unusual letters, but never before one as unusual as this. For everyone reading, this letter has been reproduced exactly as it was sent to us.

Sorry for not covering as many languages as hoped for in our Languages issue, but it wasn't due to a lack of effort. For quite some time prior to the Languages issue, we chased about trying to locate people who would be willing to write about the various languages available. For our efforts we received many promises, but few results. Such is life. The issue was still good, but did not cover the languages as extensively as hoped.

About Promal. I contacted their distributor a fair time before the Languages issue was to begin, but received the package after the issue rolled off the press. The answer to this puzzle came to me while using the package. The compiler's date stamp was just days prior to my receiving it. The package wasn't completed until after we finished the issue! Not to rain on Promal's day altogether, it seems to be a terrific package, one worthy of review in some future issue.

And finally, I like your tidy bit of advertising. If some of you missed it near the bottom of the letter, here it is again. If you are interested in other programming languages, you can contact the National Commodore Language Interest Group (NCLIG) at 1812 N. I. Street, in Fremont, NE, Zip 68025, tel# (402) 721-4346.

Monitormented: I am the proud owner and user of Commodore machines, but I'm having trouble with one of their animals, namely the 8032 Assembler/Monitor. You see, I don't have the users manual for the creature and regardless what commands I feed it – .A, .D., .R, etc. – it burps up the "?". Very aggravating! I've tried both decimal and hex for starting addresses, accumulator values, etc., to no avail. One of you guys must know how to feed it. Please HELP.

Randy Guimond, Baie Ste. Anne, New Brunswick

It sounds like you're referring to the Machine Language Monitor that resides in the 8032 ROMs. If so, it doesn't do a whole lot. It's useful, but limited. It has no Assembler, or Disassembler, or any of the more sophisticated commands found in many MLM extension programs available. Here is the command set of the resident MLM (remember, the period preceding the command is supplied by the machine).

.G Go to a specific address of code, or whatever is in the PC
.L Load a file – syntax L" drive:filename",device# (ie.08)
.M Display computer memory in hex. Syntax; .M ssss eeee ; where ssss is the start 16 bit hex address to view, and eeee is the ending 16 bit address.
.R Displays registers - alter by typing new hex values over the existing ones, and hit return
.S Save a file – syntax S" drive:filename",device # (ie. 08),start,end+1
.X Exits to Basic

However, it's also possible you're referring to a program you are loading, perhaps from a diskette. As mentioned above, this would be a monitor extension program. There are many of these – Extramon, Supermon, Micromon, to name a few – that link themselves into the resident MLM for extra commands like Hunt, Fill, Walk, and many more. If this is the case then I'm not sure which extra commands you may or may not have. If there are any, a sure clue is the Disassemble command – I can't think of any extension that doesn't include it. (Try .D followed by any 16 bit hex address) Get a copy of Extramon or Micromon, all in public domain, and then try your luck. They are guaranteed Ok.

Whereware: To begin this letter I must congratulate you on what I consider the best magazine currently available which covers the Commodore line of computers! PLEASE keep up the good work and keep the magazines coming!

In the September issue (1985) of The Transactor, there was a letter from Real Gagnon, of Quebec, asking about a 40/80 column adapter for the VIC–20 from Data–20. As of February of this year, Data–20 (at the address you listed) still had their 40/80 column adapter with 16k memory, at a close–out price of $70.95 including shipping. When I ordered one for my VIC, I got the impression that they were not moving very fast, so there may still be some left.

THANKS for the assembler program for the Rockwell R65C02 chip! I have also recently purchased and installed one in my VIC, and now I can write software for it. Now all I have to do is to re–write the screen editor in the Data–20 40/80 column adapter to utilize the new op–codes – and to correct some of the glitches in the editor.

Also, in regard to the letter from Bill Uhler, of T.R.A.C.E., I agree that when the distributor or publisher of software is no longer in business, it is a pain in the tutu. Keep in mind that often a copyright is only assigned to the marketing company for the period that it is in business, and usually reverts to the author upon the demise of the marketing company. Have you considered starting a clearinghouse, to keep track of the authors and publishers of software for Commodore computers? You could either get permission from the copyright holder to produce the software yourself, and charge for the copying, or you could maintain a database of copyright holders, and sell lists of the names. If enough people wrote to the author of a program to request permission to copy it, perhaps the author would be convinced to either start publishing it again, or release it to the public domain.

To add my own 2–cents worth to the copy protection controversy: I can well understand the viewpoint of the authors and 'publishers' of software, but I am also a buyer of software. There is only one pirate–prevention method which I have any respect for – the 'dongle' system as used by Batteries Included on their Consultant and Paperclip software packages. Not only is the software first–rate, but I can also make an infinite number of back–up copies, even give them to my friends, but only one copy will run at a time! They also make the best 80 column adapter there is for the Commodore 64! THANK YOU Batteries Included.

K.J. Rogerson, Farmington Hills, MI

Thanks for the tremendous vote of confidence. It's nice when a reader takes the time to respond to matters we expose each issue. Also, Batteries is sure to feel pleased when they read of the respect you hold for their policies and product line. I agree. Their products are fine and the dongle protection scheme is top class. If only a few more software manufacturers felt the same as the public seems to. Although disk protection is said to be used to keep prices down, all it usually accomplishes is to raise the red flag for the pirates, and to keep the legitimate purchasers ticked off at the inconvenience.

A clearinghouse is ideal theory, but implementing such a service would require a lot of legwork, and it seems there are not enough seconds in a minute as it is. Any volunteers?

More Ad-vice: I was on the brink of writing to you to ask why you don't include more advertising when in came the Nov 85 issue with John Brunner's letter on the same topic.

I have recommended Transactor to several friends, some of whom have responded that they don't like the fact that it has no advertising! I like to see some too, especially all the little ones (things like cheat sheets for example, and specialized software from little known sources).

It is a good idea to keep it all in one place, and I favour the middle. It can then be removed without harming the magazine when the file has to be thinned out maybe six months or a year after receipt. Wherever it is, it should be bound in such a manner that the advertising pages can be removed without releasing the editorial pages. I guess seven pages is a good number if it includes the back cover.

If you want to keep advertising down, but are in a position to accept ads, you have the best of both worlds. You can set the rates at a level which attracts only the number of ads you want to accommodate. Set the rates deliberately high in the first place, and if you don't get enough advertisers, reduce the rate until you achieve the desired amount. And if you are accepting ads with a certain degree of reluctance, you don't have to worry about the old adage about who pays the piper calls the tune. It doesn't apply if the piper has an independent source of income.

R.C. Eldridge Pemberton, British Columbia

Since we published John Brunner's letter of advice, we have been getting a number of really choice letters to back up Brunner's philosophy. Bob, thanks for the great advice. You may be right about the middle section of the magazine. Although it would mess up the nice flow we try so hard to attain, it would have the advantage of being quite easily removed when no longer required. Super idea.

As for your idea of setting rates as high as possible, then adjusting to get just the right amount of advertising, another bright idea. How does $5000.00 per page sound to start with? Although our print run is far below many of our competitors, we do cater to a more select crowd of people. We feel that our readers are the ones that write the software, design the hardware, and pull the trigger of the industry, as it relates to Commodore. How's that for cheeky. An advertiser with the right product would get a much better response with us than with our competition. The problem is that advertisers with quality products like to have their ads placed alongside similar products to allow comparison by the readers. Although we could sift out all but the ads for quality products, it might mean discriminating between two equally "paying customers" which isn't fair. But we're working on it! Thanks again.

CP/M In The Transactor?: I have been very pleased with the technical nature of your magazine. I only wish I could buy 12 issues a year. Keep up the good work. I have a few thoughts that keep running through my head that I'd like to pass on to you.

First, I was wondering now that I've bought a C128, do you intend to deal with the CP/M in the same way as CBM topics or would we be better advised to subscribe to a CP/M oriented magazine such as Dr. Dobb's or Language? I ask this because CP/M is almost an entirely new world, as is the Amiga, and to a lesser extent the C128. I have serious reservations that justice can be done to all this new material.

Second, I would like to respond to your intent to marginally increase the advertising content of your magazine. I, and I suspect many others, have mixed feelings on the subject. I think that advertisements can be an important source of information to the reader (I will, on occasion, buy a Byte just for a listing of available products on the market). Advertisers are obviously an important source of revenue to your magazine. I think that for your own growth as a competitive magazine you cannot ignore the necessity of incorporating more advertisements. Unfortunately, advertisements traditionally tend to provide little substance to a magazines content. I would like to suggest some possible remedies of a somewhat radical nature:

I – Enforce advertising standards. (I don't know if this has ever been done?) Insist that advertisers include user information of a technical nature. Make advertisements a coordinated segment of your magazine. I would like to see cost, content, comparisons, and more. If advertisements provided all of that then maybe people would be more accepting of them. (Can you tell advertisers what to do?)

II – Allow advertisements only on a annual basis (or longer) and charge more. This would require an index of some nature. This index could be cross–referenced by company and subject with advertisers paying for extra index entires. You could even expand the index to include references to Transactor articles. (Am I getting carried away here?) In any case, under such a plan, the information content goes up and the number of ads goes down.

III – Institute reader service cards. Incomplete information is often more irritating than no information. User cards put complete information within easy reach and, in my view, make advertisements much more palatable. I know that one of the primary reasons I am a computer nut is because I am an information nut. The more quality information you make available, the more I like you.

By incorporating these concepts, all parties should be happy. Readers have a better quality advertisement and an index to allow comparison shopping when they are interested in it. Transactor can keep down the space required for advertisements while at the same time increasing their advertising base. Advertisers are insured that readers who are interested in their product have easy access to their information for an extended period of time via the index. This format would also encourage advertisers to place ads in issues whose content relates to their product.

Finally, have you seen Info Magazine's method of providing disk versions of their listings? Rather than selling by issue, they let you choose what you want and you get charged by the number of disks sent. I find myself not ordering disks because I have little interest in half of what's on the disk. I would recommend that you consider this method. It is an exceptionally well conceived idea, and it would fit in well with an already well put together magazine.

Eric B. Wolff, Cinti, OH

We do not intend to cover the CP/M option of the C128 to any great extent. Many of the other magazines have been operating in CP/M for years now, so it would be difficult for us to break in so late and expect to compete. Covering the Amiga is another story, though. The Amiga appears to be a fresh, new entry in a market stagnating with compatibles and clones, and as such deserves a little press ala The Transactor. As a matter of fact, just a few days ago a friend of mine, Jesse Knight, called from Texas to offer his services in the Amiga writing department. Jesse has an Amiga development system and is so impressed with it that he can't wait to tell the world. We should have our own Amiga pretty soon and The T will be firmly on the receiving end of our own Amiga discoveries.

About your advertising comments, not too bad. We appreciate the time and effort you must have spent in composing your letter.

You have probably read the answer to our previous letter by now. Once again, we're working on it, and thanks again for the suggestions. As for the index, you probably have not seen some of the earlier Transactors. Each had an Advertising Index that looked much like what you describe, but quite frankly, they didn't leave much of an impact with our readers or advertisers. Or am I wrong here?

Making additional technical info a mandatory advertising requirement would be terrific for the readers. Advertising that actually lasts longer then the turn of a page. A sharp concept. But it would be difficult to enforce and we might end up right where we are – no advertisers. Indeed there are many aspects to examine.

Including a reader service card would be a natural for us if we start running ads again. Not only would it appeal to the advertisers, but it would also provide a better service to our readers. Our ads won't come cheap, but then quality goods usually don't.

The last point mentioned regarding Info Magazine's disk service is hard for me to comprehend. We deal in such a vast number of diskettes every issue that a custom selection would be next to impossible. For us, the idea would not be feasible even with reduced sales. Our staff is just not large enough to provide such a service plus get a magazine out. Sorry to say that the idea sounds great for the consumer but would be difficult to provide from our viewpoint. We're considering making our programs available for downloading from a timesharing service. However, downloading just two or three programs from one disk might cost just as much as the disk itself. Downloading three programs from three different disks might save you money, but the service may not have space for more than one of our Transactor disks at a time.

As a final note, I would like to thank you for your ideas. Through advice like yours will be built a magazine that will appeal to everyone associated with it. Thanks once again.

Medium Interest: If the magazine appears on microfiche, I will immediately switch my subscription to that medium. I will also order as many back copies as I can afford. There are certainly many others in your readership who will do likewise.

Jim Alix, North Vancouver, British Columbia

Alright! Another vote for microfiche. That adds up to two so far. For everyone reading who is so inclined, the microfiche question remains unresolved. We need your letters to qualify our decision to provide microfiche service. Thanks for taking the time to write.

SX Effects: I presently own a 64–SX computer with a single disk drive. I would like to add one more disk drive to the computer but can't get an answer from Commodore. Any help you could give me would be appreciated.

Tim Fucile, Thunder Bay, Ontario

To get the answer to your question, I went to the local SX64 expert, Jeff Goebel. His answer was yes, you can add an extra drive or two to the SX64. Of course if you add a drive that has a device number of 8, you'll have two device 8's. Not good. So the trick is to change the unit address of the internal drive first, say, to #9:

```
open1,8,15
print#1, "m-w"chr$(119)chr$(0)chr$(2)chr$(9+32)chr$(9+64)
```

Then plug in the external drive and use it as device #8.

If you want the internal drive to be #8 and the external drive #9, you'll have to do some juggling. First you'll have to send the internal drive number "to a neutral corner". Change it to, say, #15 by replacing the two 9+ in the above command string with 15+. Then plug in the external drive #8, change it to #9, and change #15 back to #8. You'll have to open two command channels, one for each device.

The reason for the computerized gymnastics is because you cannot turn off the internal drive separate from the SX64. When you connect an external drive that is still wired for device #8, you can't change the device number of one without changing

them both. A seperate power switch for the drive would have been ideal.

We get an awful lot of letters in our mailbox every working day and can imagine Commodore getting several times more. Answers often take time and research. To everybody who has ever sent us a letter but has not received a reply, please do not take it personally. It gives us great pleasure to get such reader response. However, economizing on answers is all too often necessary. It means we have to select an intersection set of questions. Commodore is no doubt bound by the same economics. Perhaps getting less questions than Commodore is one reason we have time for the occasional exception.

Bloops Blues: Not being sure if it's misprints or me, I am writing for help regarding a couple of programs in the Volume 5, Issue 04 of Transactor. (I think that's right, but not sure as on page 1 upper left in large letters it says issue 5. On bottom right of all the pages it says issue 4)

To help pinpoint the issue, it starts with a Hildon article " We're so Misunderstood! "

First problem dealt with program by Rick Illes in the Bits & Pieces section. After entering program name and type, disk runs (red light on) then screen goes to READY, keyboard locks up and drive led flashes. I have a C64 so entered the 4 changed lines 110, 120, 130, 300. Even tried it after changing 130 to read ..*peek(**56**):s=t & still no go. (yes, have proof read the entries against the printed copy)

Next comes " Learning the Languages of DOS " by Evers. On page 50, he writes " . . ..check article 'Drive Peeker' in this issue. " Well, I've looked and looked and didn't find any article titled 'Drive Peeker'; am I going blind?

Further, I typed in memory read program. It will not accept any $0000 or any number with an alpha character in it, as a start or end address. So I entered a number like 0300; however, the screen listing didn't start at 0300, the same was true no matter what starting number I used.

I will say though that I found all the articles to be informative and well written.

N.J. Schoenmaker, Ludington, Michigan

To clarify, the title of the issue in question is 'Hardware and Peripherals', Volume 5, Issue 05, dated March 1985 but actually released around December1984. The designation of Issue 04 on the bottom of each page was caused by a minor slip during typesetting. We forgot to update the border routine to reflect the correct Volume and Issue numbers. We had hoped nobody would notice.

Rick Illes Single Disk Copy Program will work by changing line 130 to read:

```
130 t=peek(55)+256*peek(56): s=t
```

As you specified, location 46 was referenced instead of 56. But after this change, the program works fine as printed.

My 'Drive Peeker' article did make it to the type shop for that issue, but was not printed due to priorities. We had such a multitude of great articles that Drive Peeker got the boot. The sad part is that my 'Learning . . .' article was not updated to reflect this last minute cut. Drive Peeker did appear in the issue following, Volume 5 Issue 06, Programming Aids and Utilities, on page 71.

The Memory–Read demonstration program in the 'Learning The Language of DOS' article does work as listed. When you run the program, though, you must enter the start and ending address to view in decimal, not hex. The routine will display the disk contents in Hex and Ascii, along with showing the current location within DOS RAM or ROM in 16 bit hex at the beginning of each eight character line. The program works, but could have used a bit more explanation I suppose.

Thanks for the final vote of confidence at the end of your letter. It's letters like yours that keep us on our toes.

SuperPet Switch Glitch: I have a few questions that I hope either you or your readers will be able to help me with. I recently purchased a Pet system. It consists of a Super Pet (SP9000), D9090 and 2031 Disk Drives, and a 8023P Printer. My first question regards the two three position switches located on the right side of the Super Pet. I have found that the one switch, marked 'Prog–6502–6809' selects from Waterloo to CBM Basic. The second switch seems to make no difference in operation of the computer regardless of its position, it is marked 'Prog–R/W–Read', what do these two switches really do?

As you may have guessed, I do not have a SP9000 manual. I received a 'Series 8000' manual. Is this the correct manual or is there a SP9000 manual and should I try to get one? The only software that I received was 'The Manager' with its two manuals and the required 'dongle' to run it. I would greatly like to get hold of the 'Waterloo' language programs for the SP9000. I have all the manuals, Basic 6809, assembler, micro apl, micro pascal, and micro fortran, but no programs. Any information as to where I could get these programs would be greatly appreciated.

With the help of a friend I have found out how to run my C64 basic programs on the SP9000, so I found some uses for the SP9000, but not the one I really want.

C. Daniel Schein Jr.
2455 McKinley Avenue
West Lawn, PA 19609

The SP9000 has 32k of user RAM at $0000–$7FFF, screen RAM at $8000–$8FFF, plus an extra 64k of Bank Switched RAM at location $9000, accessed in 16–4k blocks. In 6809 mode, with an interpreter Loaded and executing, this RAM is not to be used. The Interpreter lives in it. But, if working from 6809 assembler, or in any mode with the 6502 processor, this area is open for whatever use you may have.

There are two memory locations that are important for use when programming the SP9000. They are:

$EEF8, the System Latch
$EEFC, the Bank–Select Latch

The bit configurations are listed below.

$EEF8 System Latch

Bit	Description
0	CPU Select: 0 = Motorola 6809, 1 = MOS 6502
1	Memory Protect: 0 = Read Only, 1 = Read/Write
2	Unused
3	Diagnostic Sense
4–7	Unused

If the toggle switches are not set to their 'Prog.' positions, all work with the System Latch will be ignored. Bit 3 should be set before switching into MOS 6502 mode. This has been implemented due to the destructive reset sequence the Pet follows on reset. When the Diagnostic Sense is set, this reset sequence is not followed, thereby retaining RAM in transit.

$EEFC Bank–Select Latch

Bit	Description
0–3	RAM Bank Number In Use: 0–15
4–6	Unused
7	Must be set (1) when accessing the System Latch, otherwise should be cleared (0).

The two three position switches perform the following functions.

Switch #1

Read	When set, is the Read Only position of the bank switched RAM at $9000.
R/W	When set, allows Reading from and Writing to the RAM at $9000.
Prog.	Software control of the write protect state of the RAM at $9000 (see System Latch).

Switch #2

6809	The Motorola 6809 and Waterloo operating system is provided in this position.
6502	The MOS 6502 and Commodore operating system is provided in this position.
Prog.	Selection of the processor in use through software control (see System Latch).

The manuals supplied with the SP9000 were as follows:

The Commodore Business Computer User's Guide Series 8000
The Commodore SuperPET System Overview
The Commodore SuperPET Waterloo 6809 Assembler
The Commodore SuperPET Waterloo microAPL
The Commodore SuperPET Waterloo microBASIC
The Commodore SuperPET Waterloo microCOBOL
The Commodore SuperPET Waterloo microFORTRAN
The Commodore SuperPET Waterloo microPASCAL

The last time I looked, SAM's books carried all of the SuperPET manuals listed above.

Two diskettes were supplied with the SP9000:

1. *"The Commodore WCS", which contains the Waterloo APL, Basic, Cobol, Fortran, and Pascal interpretated languages, the 6809 Assembler/Editor system, plus the Waterloo library routines, and*

2. *The Commodore Tutorial diskette, which contains all of the tutorial examples referenced by the various software manuals supplied.*

Both diskettes were once a standard stock item for Commodore here in Canada, but that was a few years ago. You could try to contact Commodore up our way for help, or maybe even Commodore down in West Chester. You never know. Commodore may have some old stock still kicking about. Just in case they don't, I have included your complete address at the bottom of your letter. Hopefully, a kind reader will contact you to offer a few suggestions. If all else fails, you could contact The University of Waterloo in Waterloo, Ontario, Canada. Although rumour has it that they don't support the SuperPET any longer, they won't bite you for trying.

Please remember, even if you don't succeed in your quest for SuperPET information, the machine still makes a great computer. As explained earlier in this column, the 40 and 80 column Pets had quite a selection of top notch software on the market before the advent of the 64. Just find a copy of the Commodore Software Encyclopedia (SAM's Books), and go shopping. Between the software listed in this book, plus the great scads of software available through many of the older Pet users groups, there should be no trouble in locating plenty of good software. Best of luck.

TransBASIC Installment #7

Nick Sullivan
Scarborough, Ont.

TransBASIC Parts 1 to 3 Summary:

Part 1: *The concept of TransBASIC – a custom command utility that allows one to choose from a library only those commands that are necessary for a particular task.*

Part 2: *The structure of a TransBASIC module – each TransBASIC module follows a format designed to make them simple to create and "mergeable" with other modules.*

Part 3: *ROM routines used by TransBASIC – many modules make use of ROM routines burried inside the Commodore 64. Part 3 explains how to use these routines when creating new modules.*

Part 4: *Using Numeric Expressions – details on how to make use of the evaluate expression ROM routine.*

Part 5: *Assembler Compatibility – TransBASIC modules are written in PAL Assembler format. Techniques for porting them to another assembler were discussed here.*

Part 6: *The USE Command – The command 'ADD' merges TransBASIC modules into text space. However, as more modules are ADDed, merging gets slow. The USE command was written to speed things up. USE also counts the number of modules USEd and updates line 95 automatically.*

To take advantage of the TransBASIC command system, one must first obtain a copy of the TransBASIC Kernel. The Kernel is only about 500 bytes long, but the source listing of the Kernel is quite long and can't be printed each time. Volume 5, Issue 05 (Hardware & Peripherals) contains the printed listing, however The Transactor Disk for every issue will include this file, plus files from the current and all previous TransBASIC articles.

TransBasic Part 7

If you have been following TransBASIC for the last several issues, you will be relieved to learn that this installment is rather shorter than the two that preceded it. This is due to a lack of time, however, not to a lack of fresh modules, which are in plentiful supply.

Darren Spruyt is back this issue with a set of three editing commands. Included are a block delete, automatic line numbering, and line renumbering. The AUTO command in Darren's module works by intercepting the BASIC warm start vector. This marks the first time that TransBASIC has altered any system vector apart from those used by the kernel, and it introduces the possibility of a new problem that we will have to deal with.

The problem will arise when more than one module changes the same vector. When you build a TransBASIC dialect, the various modules you merge into the source code have no knowledge of each other and, if they happen to want to use a vector, there is no way for them to take into account the possibility that other modules might also be claiming that vector for their own purposes. It is not very likely that the resulting conflict would be peacefully resolved, and a crash would probably ensue.

I suppose it would be possible to graft some supervisory routine onto the kernel even at this late date, which could arbitrate access to the various vectors in some reasonable way. However, it seems better to me to deal with vector conflicts manually. To make this easy requires only that we establish a couple of rules to be followed in writing modules that alter vectors.

The first rule is that the routine to initialize the vector should be called from a line within a special area of source code labelled 'MORVEC'; and that the routine to restore the vector should be called from a another area labelled 'KILVEC'. MORVEC is permanently assigned lines 9162 through 9180; KILVEC gets the next twenty lines, from 9182 to 9200. The code in these areas is executed with JSR MORVEC on line 2125, and JSR KILVEC on line 2555. These instructions must also be included in any module that alters vectors.

The second rule requires that if a particular vector has been used by an existing module, the lines assigned to it in MORVEC and KILVEC are also to be used in any future module that alters the same vector. This will mean that if both modules occur in the same dialect, only one will function, since the second one to be merged will overwrite the initialization call of the first. This might be a nasty surprise, but it should avoid crashes.

By the way, a thorough discussion of vector conflicts, and of what can be done about them, can be found in Chris Zamara's article, 'Flexible Vector Management', in Volume 6, Issue 2.

Another module in this issue comes from Anton Treuenfels, who has provided versions of RESTORE, GOTO and GOSUB with computed destination lines. Anton's own version of this module used the keywords CRESTORE, CGOTO and CGOSUB. However, the native BASIC command is in each instance a subset of the computed command, so I dropped the Cs for the version published here. Decoding the line numbers via the

expression evaluator, as this module does, is going to be a hair slower than the conversion routine used by the ROM, but this won't often matter. If you would prefer to have the ROM commands co-exist with Anton's computed commands, change the keywords back. (This is not necessary with RESTORE, of course, since the ROM version won't accept a line number anyway.)

The other modules in this issue provide a couple of commands borrowed from LISP via LOGO (the FIRST$(and BF$(functions), and a command to return a random integer in a specified range.

Last issue The Transactor published a very handy unassembler for the C-64, by J. Lothian of Ottawa. Unfortunately for PAL users, the program generates sequential files of assembly language source code, without numbers. Such files are used by the Commodore assembler, but are not compatible with PAL. Converting from one format to the other is not arduous, however. The short BASIC program given as Program 5 will take care of converting the sequential file to a numbered program in memory. There will still be some editing needed to make the file fully PAL-compatible -- as a start, you'll need to delete the conversion routine itself, and put a SYS 700 line at the top of the file.

Next issue, look for a multicolour graphics package from Darren Spruyt, a modified INPUT or two, and more.

New Commands

AUTO (Type: Statement Cat #: 136)
Line Range: 9406-9480
Module: PRG MANAGEMENT
Example: AUTO 100,10
Begin automatic line numbering from line 100, with increments of 10. This command intercepts the BASIC warm start vector at $0302. It will not be compatible with any future TransBASIC commands that use this vector.

DEL (Type: Statement Cat #: 137)
Line Range: 9234-9404
Module: PRG MANAGEMENT
Example: DEL 275-890
Example: DEL -
Delete specified lines. The line number syntax is the same as the LIST command, except that DEL by itself does nothing. The second example is equivalent to NEW -- be careful.

REN (Type: Statement Cat #: 138)
Line Range: 9482-10096
Module: PRG MANAGEMENT
Example: REN 300-600,20,5
Example: REN 10,1
Renumber a range of lines with a specified new starting line number and increment. Statements with target line numbers (GOTO, GOSUB, ON-GOTO, etc.) are modified accordingly, with the exception of LIST and RUN. If no line range is given, as in the second example, the whole program is renumbered.

RESTORE (Type: Statement Cat #: 139)
Line Range: 10124-10148
Module: COMPUTED CMDS
Example: RESTORE
Example: RESTORE 1200
Example: RESTORE N + 100
Identical to BASIC's RESTORE statement except that, as in the second example, a line number may be given specifying a point in the program at which the next data read is to begin. The line number is evaluated as a BASIC expression, hence the third example is legal.

GOSUB (Type: Statement Cat #: 140)
Line Range: 10150-10180
Module: COMPUTED CMDS
Example: GOSUB SQR(PX + C%(6))*RND(1)/SIN(1.2)
This is a computed GOSUB. The target line is determined by evaluating the expression after the GOSUB keyword.

GOTO (Type: Statement Cat #: 141)
Line Range: 10182-10188
Module: COMPUTED CMDS
Example: GOTO 100
Example: GOTO BLAZES
This is a computed GOTO. In the second example, the target line is the determined by evaluating the variable BLAZES.

RANDOM((Type: Function Cat #: 027)
Line Range: 3216-3268
Module: RANDOM
Example: FOR I = 1 TO 220: PRINT RANDOM(100,999);
: NEXT
A random integer is returned in the specified range (inclusive). The range boundaries are treated as integers.

FIRST$((Type: Function Cat #: 028)
Line Range: 3330-3452
Module: PHRASE SPLITTERS
Example: PRINT FIRST$(" TRIALS, TROUBLES,
TRIBULATIONS")
The first word in the string argument is returned, up to but not including the first space or shifted space. Leading blanks are ignored. If the string is null or consists only of blanks, a null string is returned.

BF$((Type: Function Cat #: 029)
Line Range: 3334-3452
Module: PHRASE SPLITTERS
Example: PRINT BF$(BF$(BF$(A$)))
The argument string is returned beginning with the space or shifted space after the first word. BF stands for 'but first', after a LOGO primitive with a similar purpose. If the argument string is null, or consists only of blanks, or has only one word and no trailing blanks, a null string is returned.

Program 1: PRG MANAGEMENT

```
NG  0 rem prg management (d. spruyt 1985) :
FH  1 :
GH  2 rem 3 statements, 0 functions
HH  3 :
DJ  4 rem keyword chars: 10
JH  5 :
NJ  6 rem keyword     routine   line    ser #
FD  7 rem s/auto      car       9406    136
FD  8 rem s/del       dlt       9234    137
OE  9 rem s/ren       rnum      9482    138
OH  10 :
PJ  11 ====================================
AI  12 :
FK  139 .asc "autOdeLreN"
HA  1139 .word car-1,dlt-1,rnum-1
IC  2125          jsr  morvec
EL  2555          jsr  kilvec
OI  2620 usfp     ldx  #0
AJ  2622          stx  $0d
MA  2624          sta  $62
BH  2626          sty  $63
ON  2628          ldx  #$90
HM  2630          sec
NH  2632          jmp  $bc49
AM  2634 ;
EE  9150 errpgm   ldx  $3a        ;test hi byte of
EJ  9152          inx             ; 'curlin' = $ff
GI  9154          bne  epg1       ;no
AL  9156          rts
KI  9158 epg1     jmp  $af08      ;'syntax'
OD  9160 ;
NF  9162 morvec   =    *
NF  9164          jsr  auton      ;warm start $302
GM  9178          rts
CF  9180 ;
MJ  9182 kilvec   =    *
ID  9184          jsr  autoff     ;warm start $302
KN  9198          rts
GG  9200 ;
FN  9202 autoff   lda  wrmsrt
MH  9204          sta  $302
IE  9206          lda  wrmsrt+1
EI  9208          sta  $303
GO  9210          rts
CH  9212 ;
HK  9214 auton    lda  $302
OM  9216          sta  wrmsrt
AF  9218          lda  $303
EJ  9220          sta  wrmsrt+1
OK  9222          lda  #>auto
EJ  9224          sta  $303
GL  9226          lda  #<auto
EJ  9228          sta  $302
KP  9230          rts
GI  9232 ;
HB  9234 dlt      jsr  errpgm
LL  9236          jsr  $a96b      ;get fixed pt number
EK  9238          ldx  #$50
AC  9240          jsr  store      ;save it
KA  9242          cmp  #$ab       ;"-" token value
OD  9244          bne  dlt2
OB  9246          jsr  $73
OD  9248          bne  dlt1
KL  9250          lda  #$ff       ;if no top, then
OA  9252          sta  $52        ;set upper
MI  9254          sta  $53        ;limit to $ffff
CF  9256          bne  dlt4
DC  9258 dlt1     jsr  $a96b      ;get fixed pt num
LJ  9260 dlt2     sec
JM  9262          lda  $14        ;move top line
FF  9264          sta  $52        ;num to ($52)
DL  9266          sbc  $50        ;and check that
GF  9268          lda  $15        ;num2 >= num1
DA  9270          sta  $53
BN  9272          sbc  $51
HH  9274          bcs  dlt3
JD  9276          jmp  $af08      ;'syntax'
PH  9278 dlt3     inc  $52        ;bump num2
KG  9280          bne  dlt4
BP  9282          inc  $53
CM  9284 dlt4     ldx  #$50
OD  9286          jsr  uns        ;num1 to ($14)
OH  9288          jsr  $a613      ;find line
DG  9290          lda  $5f        ;copy pntr
IK  9292          sta  $22        ; to ($22)
GN  9294          lda  $60
HB  9296          sta  $23
II  9298          ldx  #$52       ;num2 to ($14)
DB  9300          jsr  uns
MI  9302          jsr  $a613      ;find line
GO  9304          jmp  dlt11      ;skip over seg
MM  9306 dlt5     sec
AB  9308          lda  $2d        ;move from
FA  9310          sbc  $5f        ; ($5f)-($2d)
CF  9312          sta  t2         ; to ($22) ↑
AN  9314          lda  $2e        ;calc pages
OJ  9316          sbc  $60        ; + remainder $02
BD  9318          tax
EE  9320          inx
FL  9322          ldy  #0
NE  9324          beq  dlt7       ;init .y
DN  9326 dlt6     lda  ($5f),y    ;transfer data
AH  9328          sta  ($22),y
CF  9330          iny
GK  9332          bne  dlt6
OB  9334          inc  $60
BC  9336          inc  $23
LC  9338 dlt7     dex             ;more pages
GL  9340          bne  dlt6       ;yes
GG  9342 dlt8     cpy  $02
DN  9344          beq  dlt9
GK  9346          lda  ($5f),y    ;copy remainder
EI  9348          sta  ($22),y
GG  9350          iny
CM  9352          bne  dlt8
NJ  9354 dlt9     tya  ;calculate
DD  9356          clc             ; new start-of-
AC  9358          adc  $22        ; variables pntr
```

```
KI | 9360          sta  $2d
HL | 9362          bcc  dlt10
ND | 9364          inc  $23
CM | 9366 dlt10    lda  $23
FJ | 9368          sta  $2e
GI | 9370          rts
JB | 9372 dlt11    jsr  dlt5      ;move mem
JC | 9374          jsr  $a533     ;re-chain
AC | 9376          jsr  $a659     ;clr/fix pntrs
IJ | 9378          jmp  $a474     ;return to ready
KB | 9380 ;
LN | 9382 store     ldy  $14       ;copy from
OG | 9384          sty  0,x       ; ($14) to
DB | 9386          ldy  $15       ; 0,x
DE | 9388          sty  1,x
KJ | 9390          rts
GC | 9392 ;
DL | 9394 uns       ldy  0,x       ;copy from
IF | 9396          sty  $14       ; 0,x
FK | 9398          ldy  1,x       ; to ($14)
DO | 9400          sty  $15
GK | 9402          rts
CD | 9404 ;
GJ | 9406 car       jsr  errpgm    ;auto function
AI | 9408          jsr  $a96b     ;get num
NL | 9410          jsr  aneval    ;evaluate expr
HH | 9412          sta  step      ;step value
PE | 9414          lda  $51
OK | 9416          ldy  $50
OM | 9418          ldx  #1        ;set flag
IG | 9420          stx  cont
BJ | 9422          jmp  aut3      ;print value
GE | 9424 ;
EE | 9426 auto      ldy  $200      ;($302) vector
IL | 9428          bne  aut1      ;line entered
HP | 9430          sty  cont      ;zero lock
LH | 9432 aut1      ldy  cont      ;get lock
MB | 9434          beq  aut5      ;no go
HE | 9436          lda  $14       ;take currline#
GF | 9438          clc            ;and add step
EL | 9440          adc  step      ; value to it
KO | 9442          bcc  aut2
BJ | 9444          inc  $15
IL | 9446 aut2      tay
FH | 9448          lda  $15
MJ | 9450 aut3      jsr  strng     ;make string
LB | 9452          ldy  #$ff      ;push string
ED | 9454 aut4      iny            ; into kb buffer
MA | 9456          lda  $100,y
PH | 9458          sta  $277,y
NC | 9460          bne  aut4
PL | 9462          lda  #$20      ;add space
FI | 9464          sta  $277,y
KN | 9466          iny
GO | 9468          sty  $c6       ;set buff chars
EJ | 9470 aut5      lda  wrmsrt
KC | 9472          sta  $14       ;create indirect
EF | 9474          lda  wrmsrt+1
PM | 9476          sta  $15
CL | 9478          jmp  ($14)     ;jmp thru
```

```
OH | 9480 ;
OA | 9482 rnum      jsr  errpgm
EI | 9484          jsr  $a96b     ;eval num
AM | 9486          cmp  #$ab      ;" - " token
DD | 9488          bne  rnm3
CC | 9490          ldx  #$45      ;save start line
OI | 9492          jsr  store
GB | 9494          jsr  $73
CI | 9496          cmp  #$2c      ;disallow comma
JD | 9498          bne  rnm2
MA | 9500 rnm1      jmp  $af08     ;'syntax'
EC | 9502 rnm2      jsr  $79
IJ | 9504          jsr  $a96b     ;eval num
CI | 9506          cmp  #$2c      ;comma required
PD | 9508          bne  rnm1
IO | 9510          ldx  #5        ;save end line
CK | 9512          jsr  store
KC | 9514          jsr  $73
EK | 9516          jsr  $a96b     ;eval num
OI | 9518          cmp  #$2c      ;comma required
LE | 9520          bne  rnm1
OG | 9522          beq  rnm4
LJ | 9524 rnm3      ldy  #0        ;if no start/end
IA | 9526          sty  $45       ; were specified
FF | 9528          sty  $46       ; renumber whole prg
FP | 9530          dey
HP | 9532          dey
CA | 9534          sty  t5
GA | 9536          sty  t6
IE | 9538 rnm4      jsr  aneval    ;eval start/step
CC | 9540          inc  t5        ;bump end
BH | 9542          bne  rnm5
AJ | 9544          inc  t6
NC | 9546 rnm5      lda  $45       ;($45) to ($14)
EB | 9548          sta  $14
EO | 9550          lda  $46
LB | 9552          sta  $15
II | 9554          jsr  $a613     ;find line
BE | 9556          lda  $5f       ;($5f) to ($ac) as
AN | 9558          sta  $ac       ; pntr to start of
GG | 9560          lda  $60       ; section to be
NC | 9562          sta  $ad       ; renumbered
EE | 9564          lda  t5        ;($05) to ($14)
GC | 9566          sta  $14
II | 9568          lda  t6
NC | 9570          sta  $15
NM | 9572          jsr  fndlin    ;calc new top line#
DL | 9574          ldy  #1
DI | 9576          lda  ($5f),y
PF | 9578          beq  rnm7      ;link zero-okay
MC | 9580          ldy  #3        ;next line hi
JI | 9582          lda  ($5f),y
IL | 9584          cmp  $ab       ;new top hi
BK | 9586          bne  rnm6
PC | 9588          dey
EH | 9590          lda  ($5f),y    ;next line lo
DN | 9592          cmp  $aa       ;new top lo
MJ | 9594 rnm6      bcs  rnm7      ;no conflict
IB | 9596          jmp  $b248     ;illegal quantity
KE | 9598 rnm7      lda  #0        ;clr on/goto/gosub
```

```
JD 9600          sta  onflg    ; flag
GO 9602          lda  $2b      ;start-of-basic
AB 9604          sta  $3f      ; to ($3f) trace
PD 9606          lda  $2c
KE 9608          sta  $40
DN 9610 rnm8     ldy  #2
OG 9612          lda  ($3f),y  ;copy line number
JG 9614          sta  $39
LB 9616          iny           ;to ($39)
HK 9618          lda  ($3f),y
HI 9620          sta  $3a
BH 9622 rnm9     iny
NK 9624 rnm10    lda  ($3f),y  ;get byte
OI 9626          beq  rnm14    ;zero byte
AM 9628          cmp  #$3a     ;colon
CA 9630          beq  rnm14
KI 9632          cmp  #$89     ;goto token
IA 9634          beq  rnm16
CM 9636          cmp  #$8d     ;gosub token
MA 9638          beq  rnm16
LF 9640          cmp  #$cb     ;go token
CE 9642          bne  rnm11    ; followed by to
BD 9644          jsr  nxtch1
HG 9646          cmp  #$a4     ;token to
GB 9648          beq  rnm16
NP 9650          bne  rnm10
NP 9652 rnm11    cmp  #$a7     ;then token
DA 9654          bne  rnm12
ND 9656          jsr  nxtch1
ED 9658          cmp  #$30     ;check for
GM 9660          bcc  rnm10    ; numeric
DH 9662          cmp  #$3a
JO 9664          bcc  rnm17
EC 9666          bcs  rnm10
HK 9668 rnm12    cmp  #$91     ;on token
EB 9670          bne  rnm13
HN 9672          sta  onflg    ;set on flag
OD 9674          jmp  rnm9
AK 9676 rnm13    cmp  #$2c     ;commas
AC 9678          bne  rnm9     ;fetch next byte
FF 9680          lda  onflg
ON 9682          beq  rnm9     ;on not active
FL 9684          bne  rnm16    ;on active
DF 9686 rnm14    ldx  #0
PE 9688          stx  onflg    ;clr on state
OP 9690          cmp  #$3a     ;colon
LG 9692          beq  rnm9     ;fetch next
NH 9694          ldy  #1       ;check link hi
FP 9696          lda  ($3f),y
OL 9698          beq  rnm15    ;end of memory
PK 9700          tax
BK 9702          dey
FA 9704          lda  ($3f),y  ;get link lo
MO 9706          sta  $3f
KA 9708          stx  $40
DA 9710          jmp  rnm8     ;start new line
OH 9712 rnm15    ldx  #5
BL 9714          jsr  uns
IJ 9716          jsr  number   ;renumber lines
KG 9718          jsr  $a659    ;clr
GD 9720          jmp  $a474    ;'ready.'
NI 9722 rnm16    iny           ;next char
PA 9724 rnm17    jsr  rnm18    ;change l#
AO 9726          ldy  $97      ;restore .y
EK 9728          jmp  rnm10    ;return
IL 9730 ;match for change
FB 9732 rnm18    jsr  nextch   ;cut thru space
OC 9734          sty  $97      ;save .y
NM 9736          clc           ;fix chrget
FG 9738          tya           ; to .y plus
CD 9740          adc  $3f      ; ($3f) - also
IK 9742          sta  $7a      ; to ($41)
FN 9744          sta  $41
GJ 9746          lda  $40
BP 9748          adc  #0
ON 9750          sta  $42
GB 9752          sta  $7b
IP 9754          jsr  $79      ;set flags
FI 9756          jsr  $a96b    ;eval number
PJ 9758          sec
IA 9760          lda  $7a      ;find length
AI 9762          sbc  $41      ;of
CI 9764          sta  t2
DG 9766          sec           ;chk number is
IC 9768          lda  $14      ; in range
AG 9770          sbc  t5
JL 9772          lda  $15
GG 9774          sbc  t6
GG 9776          bcs  rnm19    ;line above top
DL 9778          sec
OL 9780          lda  $14
JN 9782          sbc  $45
FM 9784          lda  $15
AO 9786          sbc  $46
AO 9788          bcs  rnm20    ;line below bottom
BM 9790 ;line to be renumbered here
OF 9792 rnm19    jmp  rnm31
NB 9794 rnm20    jsr  fndlin   ;figure new l#
JK 9796          ldy  #$ff     ;new line at $100
IA 9798 rnm21    iny
EG 9800          lda  $100,y
KJ 9802          bne  rnm21
LM 9804          tya           ;new length
PM 9806          sec
LA 9808          sbc  t2       ;sub initial len
PP 9810          bmi  rnm26    ;remove some
LD 9812          beq  rnm28    ;right size
IL 9814 ;add in .a spaces
GL 9816          sta  t2
LN 9818          sec
MK 9820          lda  $38      ;check for space
JB 9822          sbc  $2e      ;between end of mem
HH 9824          bne  rnm22    ;and start of
BI 9826          sec           ;variables
LP 9828          lda  $37
CD 9830          sbc  $2d
NM 9832          cmp  t2
LL 9834          bcs  rnm22    ;space available
MG 9836          jmp  $a435    ;out of memory
BK 9838 rnm22    lda  $41      ;start of block
```

```
GH 9840          sta  $5f
IN 9842          lda  $42       ;to move  ($5f)
KD 9844          sta  $60
FP 9846          lda  $2d       ;end of block
PG 9848          sta  $5a
MG 9850          ldx  $2e       ;to move  ($5a)
CN 9852          stx  $5b
DF 9854          clc            ;end of new block
CJ 9856          adc  t2
GP 9858          bcc  rnm23     ;when moved
AG 9860          inx
IM 9862 rnm23    stx  $2e       ;($58)
CI 9864          sta  $2d
GG 9866          sta  $58
HM 9868          stx  $59
NB 9870          inc  $5a       ;inc ($5a) by 1
DO 9872          bne  rnm24
OG 9874          inc  $5b
LD 9876 rnm24    inc  $58       ;inc ($58) by 1
KO 9878          bne  rnm25
JF 9880          inc  $59
PE 9882 rnm25    jsr  $a3bf     ;move memory
GC 9884          jmp  rnm28     ;put in line #
CO 9886 rnm26    eor  #$ff
GB 9888          clc
HO 9890          adc  #1        ;calc # bytes move
CA 9892          sta  t2
JP 9894          lda  $41       ;($22) = bottom
MG 9896          sta  $22
AJ 9898          ldx  $42       ;($5f) = old bottom
PM 9900          stx  $23
AF 9902          clc            ;dlt5
CM 9904          adc  t2
II 9906          sta  $5f       ;move ($5f)-($2d)
BO 9908          bcc  rnm27
JB 9910          inx            ;to ($22)-($2d)
FG 9912 rnm27    stx  $60
LD 9914          jsr  dlt5
GF 9916 rnm28    ldy  #0        ;put in linenum
HI 9918 rnm29    lda  $100,y
IC 9920          beq  rnm30
EM 9922          sta  ($41),y
EK 9924          iny
IH 9926          bne  rnm29     ;finish up
LE 9928 rnm30    jsr  $a533     ;re-chain
AL 9930 rnm31    rts            ;end
CE 9932 ;
FP 9934 fndlin   lda  #0        ;finds line, calcs
AK 9936          lda  #0        ; new line number
NK 9938          .byte $2c
PC 9940 number   lda  #$80      ;also renums
BB 9942          sta  numb      ;if entry number
OF 9944          lda  $50
JO 9946          sta  $aa
FG 9948          lda  $51
PK 9950          sta  $ab       ;set start l#
KL 9952          lda  $ad
FB 9954          ldx  $ac
ML 9956 fdln1    stx  $5f
JA 9958          sta  $60       ;set start pntr
```

```
HA 9960 ;assumed line# is in ($14)
LD 9962          ldy  #3
PO 9964          lda  ($5f),y   ;get line hi
DD 9966          cmp  $15       ;check it
OI 9968          bne  fdln2
NK 9970          dey
BB 9972          lda  ($5f),y   ;get line lo
GA 9974          cmp  $14       ;test if found
HJ 9976          beq  fdln6     ; yes
BN 9978 fdln2    bcs  fdln5     ; no
LG 9980          bit  numb      ;test renum pass
LF 9982          bpl  fdln3     ;no
AB 9984          ldy  #2        ;yes, put
CO 9986          lda  $aa       ; new line number
PE 9988          sta  ($5f),y   ; into memory
KN 9990          lda  $ab
IO 9992          iny
DG 9994          sta  ($5f),y
DA 9996 fdln3    lda  $aa       ;take ($aa) and
DG 9998          clc            ; add step value
OI 10000         adc  $52
BC 10002         sta  $aa
LI 10004         bcc  fdln4
KA 10006         inc  $ab
MO 10008         lda  $ab
IL 10010         cmp  #$fa      ;test over 64000
PC 10012         bcc  fdln4     ;no
FJ 10014         jmp  $b248     ;'illegal quantity'
BI 10016 fdln4   ldy  #0
KB 10018         lda  ($5f),y   ;get new link lo
PO 10020         tax
IM 10022         iny            ;get new link hi
DE 10024         lda  ($5f),y
DD 10026         bne  fdln1     ;continue if >0
OH 10028 fdln5   lda  #$f9      ;drop here if  =0
OB 10030         ldy  #$ff      ;set num to 63999
GK 10032 ;
MI 10034 strng   jsr  usfp      ;make fp val
OB 10036         jmp  $bddf     ;make strng at $100
MA 10038 fdln6   lda  t2        ;if old len 0 then
GB 10040         beq  fdln5     ;make new 63999
OA 10042         lda  $ab
NG 10044         ldy  $aa
CN 10046         jmp  strng     ;make string
GL 10048 ;
KH 10050 aneval  ldx  #$50      ;evaluate two
EK 10052         jsr  store     ; params & save
MA 10054         jsr  $73       ;used
BK 10056         jsr  $b79e     ; with num
MB 10058         stx  $52       ; and auto
AA 10060         txa
FA 10062         bne  anev1
BF 10064         jmp  $b248
DC 10066 anev1   rts
KM 10068 ;
JN 10070 nxtch1  iny            ;skip thru
AG 10072 nextch  lda  ($3f),y   ; until
FA 10074         cmp  #$20      ; non-space
DK 10076         beq  nxtch1
KE 10078         rts
```

```
GN | 10080 ;
BE | 10082 .if >(*&255)+7: *=*+(*&1)
KC | 10084 wrmsrt.word 0
MN | 10086 ;
OL | 10088 cont    .byte 0
AG | 10090 step    .byte $0a
LM | 10092 onflg   .byte 0
DH | 10094 numb    .byte 0
GO | 10096 ;
```

Program 2: COMPUTED CMDS

```
EA | 0 rem computed cmds (a. treuenfels) :
FH | 1 :
GH | 2 rem 3 statements, 0 functions
HH | 3 :
NE | 4 rem keyword characters: 16
JH | 5 :
NJ | 6 rem keyword      routine     line      ser #
GG | 7 rem s/restore    restor      10124     139
HI | 8 rem s/gosub      cgosub      10150     140
MD | 9 rem s/goto       cgoto       10182     141
OH | 10 :
JD | 11 rem ================================
AI | 12 :
AI | 140 .asc "restorEgosuBgotO"
NC | 1140 .word restor-1,cgosub-1,cgoto-1
LM | 10124 restor  jsr  $79      ;chk end of stmt
IH | 10126         bne  crs1     ;no
EG | 10128         jmp  $a81d    ;regular restore
CP | 10130 crs1    jsr  $ad8a    ;get num expr
PG | 10132         jsr  $b7f7    ;conv to line #
MG | 10134         jsr  $a613    ;search for line
PO | 10136         bcc  crs2     ; not found
NA | 10138         lda  $5f      ;line link low
PF | 10140         sbc  #1       ;find line start
BB | 10142         ldy  $60      ;line link high
EB | 10144         jmp  $a824    ;set data ptr
DI | 10146 crs2    jmp  $a8e3    ;'undef'd stmt'
KB | 10148 ;
PD | 10150 cgosub  lda  #3       ;chk stack space
GB | 10152         jsr  $a3fb
FB | 10154         lda  $7b      ;save chrget ptr
IC | 10156         pha
LG | 10158         lda  $7a
MC | 10160         pha
GI | 10162         lda  $3a      ;push crnt line #
AD | 10164         pha
DF | 10166         lda  $39
ED | 10168         pha
GM | 10170         lda  #$8d     ;push gosub token
ID | 10172         pha
JB | 10174         jsr  $79      ;get crnt char
NF | 10176         jsr  cgoto    ;get subrtn strt
FO | 10178         jmp  $a7ae    ;execute stmts
KD | 10180 ;
KK | 10182 cgoto   jsr  $ad8a    ;get num expr
DK | 10184         jsr  $b7f7    ;conv to line #
DG | 10186         jmp  $a8a3    ;enter goto rtn
CE | 10188 ;
```

Program 3: RANDOM

```
PA | 0 rem random (aug 24/84)          :
FH | 1 :
EC | 2 rem 0 statements,  1 function
HH | 3 :
HO | 4 rem keyword characters: 7
JH | 5 :
NJ | 6 rem keyword      routine     line      ser #
JE | 7 rem f/random(    rndm        3216      027
MH | 8 :
DI | 9 rem u/pshfp1 (3270/063)
HI | 10 rem u/pul57 (3308/064)
PH | 11 :
KD | 12 rem ================================
BI | 13 :
KM | 605 .asc "random"
EO | 1605 .word rndm-1
LJ | 3216 rndm   jsr  $ad8a     ;eval num1
CE | 3218         jsr  $bccc     ;conv to integer
HD | 3220         jsr  pshfp1    ;push fac 1
HC | 3222         jsr  $aefd     ;check comma
NA | 3224         jsr  $aef4     ;eval num2, chk )
KE | 3226         jsr  $bccc     ;conv to integer
DE | 3228         jsr  $b849     ;add 0.5 twice
MM | 3230         jsr  $b849
IA | 3232         jsr  pul57     ;pull num1 to $57
AP | 3234         lda  #$57
PO | 3236         ldy  #0
AP | 3238         jsr  $b850     ;num1-num2
II | 3240         jsr  $bc2b     ;get sign of result
LD | 3242         cmp  #1        ;test if positive
AN | 3244         beq  rdm1      ;yes
GL | 3246         jsr  $bc58     ;abs(fac 1)
FG | 3248         jsr  $bbc7     ;copy fac 1 to $5c
KD | 3250         jsr  $e0be     ;rnd(1) to fac 1
BJ | 3252         lda  #$5c      ;* (num2+1-num1)
BA | 3254         ldy  #0
IP | 3256         jsr  $ba28
EI | 3258         lda  #$57      ; + num1
HA | 3260         ldy  #0
CP | 3262         jsr  $b867
GF | 3264         jmp  $bccc     ;conv to integer
OA | 3266 rdm1     jmp  $b248     ;'illegal quantity'
KD | 3268 ;
EG | 3270 pshfp1  lda  #3        ;chk stack space
GD | 3272         jsr  $a3fb
FC | 3274         pla            ;save return addr
HJ | 3276         sta  $71
GF | 3278         pla
OJ | 3280         sta  $72
CH | 3282         jsr  $bbca     ;fac 1 to $57
LB | 3284         ldx  #0
GC | 3286 phf1     lda  $57,x     ;push $57-$5b
EF | 3288         pha
GL | 3290         inx
PD | 3292         cpx  #5
GN | 3294         bne  phf1
DH | 3296 phf2     lda  $72       ;restore rts addr
OF | 3298         pha
```

```
BH  3300          lda  $71
CG  3302          pha
EN  3304          rts
AG  3306 ;
GA  3308 pul57    pla            ;save return addr
JL  3310          sta  $71
IH  3312          pla
AM  3314          sta  $72
AI  3316          ldx  #4        ;pull $57-$5a
NA  3318 pl57     pla
JN  3320          sta  $57,x
BL  3322          dex
DA  3324          bpl  pl57
EO  3326          bmi  phf2      ;branch always
GH  3328 ;
```

Program 4: PHRASE SPLITTERS

```
AO  0 rem phrase splitters (aug 25/84)   :
FH  1 :
DH  2 rem 0 statements, 2 functions
HH  3 :
DE  4 rem keyword characters: 11
JH  5 :
NJ  6 rem keyword     routine     line     ser #
NF  7 rem f/first$(   first       3330     028
NO  8 rem f/bf$(      bf          3334     029
NH  9 :
ID  10 rem ================================
PH  11 :
IF  606 .asc "first$bf$"
JH  1606 .word first-1,bf-1
CP  3330 first    sec            ;flag set = first
AN  3332          .byte $24
OB  3334 bf       clc            ;flag clr = bf
JO  3336          php            ;push flag
FO  3338          jsr  $aef4     ;eval str, check )
LD  3340          jsr  $b6a3     ;set up ptr to str
MN  3342          sta  t3        ;save length
PE  3344          txa            ;push str data addr
OI  3346          pha
LM  3348          tya
CJ  3350          pha
GF  3352          lda  t3        ;reserve space in
CG  3354          jsr  $b47d     ; string storage
PL  3356          pla            ;store data addr
DN  3358          sta  $23       ; at ($22)
IK  3360          pla
GO  3362          sta  $22
JJ  3364          ldy  #$ff      ;set up .y index,
DM  3366          sty  t4        ; and flag in t4
GG  3368 fbf1     iny            ;bump index
HA  3370 fbf2     cpy  t3        ;test = str len
HD  3372          beq  fbf4      ;yes
PE  3374          lda  ($22),y   ;test current str
BL  3376          and  #$7f      ; byte is space
LG  3378          cmp  #" "      ; or shift-space
LD  3380          beq  fbf3      ;yes
HH  3382          lda  #0        ;clear flag - not
GF  3384          sta  t4        ; a space
OA  3386          beq  fbf1      ;branch always
JF  3388 fbf3     bit  t4        ;test prev char was
IH  3390          bpl  fbf4      ; space - no
BM  3392          dec  t3        ;dec effective str
GP  3394          inc  $22       ; len, bump
PF  3396          bne  fbf2      ; effective addr
PO  3398          inc  $23
LA  3400          bne  fbf2      ;branch always
OP  3402 fbf4     plp            ;test if 'first'
NF  3404          bcs  fbf5      ;yes
EP  3406          tya            ;push index
MM  3408          pha
BO  3410          sec            ;subtract from
EM  3412          sbc  t3        ; str len
OP  3414          eor  #$ff
OM  3416          clc
JD  3418          adc  #1
DB  3420          tay            ;use as new index
PP  3422          pla            ;add old index to
FI  3424          adc  $22       ; address
GC  3426          sta  $22
NC  3428          bcc  fbf5
PA  3430          inc  $23
AM  3432 fbf5     tya            ;reserve space for
NJ  3434          jsr  $b47d     ; new string
LD  3436          tay
EE  3438 fbf6     dey            ;copy string to
NO  3440          cpy  #$ff      ; new space
BI  3442          beq  fbf7
GD  3444          lda  ($22),y
CI  3446          sta  ($62),y
FE  3448          bcc  fbf6
OE  3450 fbf7     jmp  $b4ca     ;create descriptor
CP  3452 ;
```

Program 5: Convert SEQ source to PAL source

```
IG  1 open1,8,2,"0:seqfile":l=1000
CP  2 print"  Sq  ":fori=0to8:printl;:l=l+2
IK  3 get#1,a$:s=-(st=0):ifs=0goto5
NH  4 ifa$<>chr$(13)thenprinta$;:goto3
GD  5 print:nexti
EG  6 ifsthenprint"l=";l;":poke152,1:goto2"
LJ  7 fori=631to639+s:pokei,13:next
CD  8 poke198,9+s:close1-s:print"  s  ";:end
NH  9 :
```

The Commodore 128: Impressions and Observations

John Holttum
Seattle, WA

Since I have been commissioned by a local software company to translate a book of BASIC 2.0 games to BASIC 7.0, I was able to obtain a C128 and 1571 directly from Commodore during the first week of September (as part of my contract). Now, even with three weeks of programming and evaluation time under my belt, the honeymoon is far from over. As I've told some of my friends, programming in 128 mode evokes feelings close to guilt that so much is so easy! It makes one realize how inhibiting BASIC 2.0 can be. Yet there have also been some disappointments which are worth bringing to light.

First, the machine is not 100% bug–free; not that anyone expected it to be, but one always hopes. So far the problems seem minor. One merely academic bug is in the sequence which brings the keyboard out of auto–insert mode (yes, Virginia, there is auto–insert, and flash, and on–screen underlining). It does not work as stated. That is, if you enable auto–insert with ESC–A, you won't get out of it with ESC–O. However, there is an alternate sequence (ESC–C) which does disable the feature as well as cancelling quote mode.

The second problem is a little more sobering. The SAVE–@ bug is alive and well in the 1571!! I was one of those individuals who had never had too much trouble with SAVE–@ on my 1541, having only been stung by it once even with liberal use of the command. Yet my 1571 has already replaced inappropriate files twice while in 128 mode. Personally, I think the bug is an ancient Gypsy curse placed on CBM and all its descendants, but who's to say?

My final complaint is not a bug at all, but a bit of frustration over the user's manual. As promised, this is the first clearly written and truly attractive book seen from CBM, but I'm repeatedly disappointed by how shallow the material is. Perhaps we C64 hackers are spoiled, having "grown up" with such a well–understood machine. I know that my own history with Apple computers and documentation makes the new 128 manual look more than adequate in content. Still, I am irritated that there is no detailed memory map nor table of vital memory locations (like keyboard buffer, character sets, etc.). Furthermore, the CP/M section offers little practical information, especially for those of us new to the venerable operating system. I asked CBM about that and about the ESC–O problem through Compuserve's CBM Hotline and was informed that the new reference manual was on the way to the printers, whatever that means, but that the Service Manual (part #314001–07) is available by sending $28.00 to the following address:

Commodore Service Dept.
C–2654
1200 Wilson Drive
West Chester, PA 19380

They knew nothing about the ESC–O bug, but said they would contact the Technical Support Group about it. It may be unique to my machine. So as not to sound too negative, let me say that the BASIC 7.0 encyclopedia contained in the manual is very helpful and well–organized.

So what do I really think of the 128? I think it's undoubtedly Commodore's best effort to date. And despite the above irritations I find it the most satisfying PC I've worked on yet, including the Apple IIe, II+, IIc, C64, and IBM PC. The 128 mode is not just a fat C64. The ESC sequences provide for editing functions far above those for the 64, such as downward scrolling of text, line insertion, partial screen clearing, and easy window formation, all of which are available within programs as well. The 1571 seems to be able to read anything I put into it, including Kaypro disks, old C64 CP/M disks, and a couple I don't know what they are. RGB output to my $249 Sears TVS monitor (requires a $15 cable and includes a TV and composite monitor) is quite nice. It's not the Amiga, but frankly, on my budget, I neither need nor want an Amiga. The 128 system is certainly more computer than I expected to own for many years.

Observations

In the interest of revealing the 128's innards, I have noted three keyboard scanning memory locations I divined by continuously displaying the first 256 bytes of memory on screen and pressing keys to see what happened. I hope they're helpful.

Locations 212 and 213 read most of the keys on the 128 keyboard. The values returned when one of these locations is PEEKed are listed below. These values remain the same whether or not the CONTROL, SHIFT, or CBM keys are also pressed.

A-10	L-42	W-9	7	-24	:	-45	F7/F8	-3
B-28	M-36	X-23	8	-27	;	-50	ESC	-72
C-20	N-39	Y-25	9	-32	,	-47	TAB	-67
D-18	0-38	Z-12	+	-40	.	-44	HELP	-64
E-14	P-41	0-35	-	-43	/	-55	L.FEED	-75
F-21	Q-62	1-56	£	-48	=	-53	NO SCROLL	-87
G-26	R-17	2-59	HOME	-51	←	-57	RETURN	-1
H-29	S-13	3-8	DEL	-0	SPACE	-60	NO KEY	-88
I-33	T-22	4-11	↑	-54	F1/F2	-4		
J-34	U-30	5-16	*	-49	F3/F4	-5		
K-37	V-31	6-19	@	-46	F5/F6	-6		

The Keypad on the right has codes separate from the number keys on the main keyboard. They are:

0-81	3-79	6-77	9-78	-	-74
1-71	4-69	7-70	.-82	ENTER	-76
2-68	5-66	8-65	+-73		

Likewise, the cursor keys above the keyboard have different codes from those at the bottom. At the bottom, the LEFT/RIGHT key has a value of 2, while the UP/DOWN key has a 7. At the top of the keyboard, UP = 83, DOWN = 84, LEFT =85, and RIGHT = 86.

CONTROL, C= (CBM logo), SHIFT, ALT, and CAPS LOCK are all read by location 211. It appears that the first three bits of this byte indicate the status of SHIFT, C=, and CONTROL, respectively, since the value of PEEK(211) is 1 if SHIFT alone is pressed, 2 if C= only is being pressed, and 4 if just CONTROL is pressed. A value of 3 is returned if SHIFT and C= are held simultaneously, 5 for SHIFT and CONTROL, and 7 for all three. Similarly, ALT and CAPS LOCK are represented by bits 4 and 5, respectively. The value of PEEK(211) is 8 when ALT is pressed and 16 when CAPS LOCK is on.

These locations peeked alone or in combination give you control over input of any key on the 128's keyboard, even keys that aren't recognized by the GET or GETKEY commands.

The 128 is not to be underestimated. There is much more to it than at first appears. Happy scanning!

Machine Language: Maxims for the Commodore 128

Jim Butterfield
Toronto

. . .the Commodore 128 doesn't call for a new game. . .
. . .but there are some new things you'll need to know. . .

The 8500 processor in the Commodore 128 follows the same rules and uses the same instructions as previous Commodore microprocessors – the 6502, 6510, 7501, 6509, etc. There are no new instructions; there's only a new arrangement of pins on the chip (and a new speed capability which can be invoked).

If you know your way around machine language on other Commodore machines, you'll be at home. Same instruction set, same Kernal, similar architecture. But there are some new things you'll need to know.

Here's a set of rules which will keep you out of trouble when you try your hand at programming the Commodore 128 in its C128 mode. All these rules may be broken – when you're smart enough and know your way around. But they will keep you out of trouble when you're just feeling your way around.

1. Use only BANK 15. In fact, you can get along without using the BANK command at all, since bank 15 will be selected if you haven't changed it.
2. Keep program and data below address $4000. Below this point, there isn't much conflict between banks.
3. If you want to put coding into the cassette buffer, remember it starts at $0B00. Nobody except the cassette uses that page, so you can use the area from $0B00 to $0BFF without worry.
4. Don't try to POKE the screen – the 80 column screen, in particular, is not mapped into main memory. Use the Kernal's CHROUT – $FFD2 – in the conventional way.
5. The built–in machine language monitor is convenient. It's similar to Supermon. Call it in from Basic with MONITOR, not with some kind of SYS command. You don't need to give a five–character address in most cases when you want to do things such as examine memory, change memory, disassemble, and so on.
6. You'll find the I/O chips at the same addresses as on the Commodore 64, used for 40–column screen, sound, I/O, etc. Feel free to use them in the traditional way, but stay away from (formerly) unused addresses; they may be live and may do unpleasant things to the system.
7. If you need space in zero page for indirect address pointers, use $FA to $FF (decimal 250–255).
8. Remember that Basic programs will start at address $1C01; this may influence where you want to put your program. Remember that Start–of–Variables no longer tells you where your Basic program ends (variables are stored in a different memory bank). Avoid the GRAPHIC command in Basic unless you know what you're doing; it will reorganize memory and move things around.

Remember: you may break any and all of the above rules when you're ready. When you start, using the rules will help you get working programs going.

Simple Example

Let's write an idiotically simple program to print the alphabet on the screen. Go into C128 mode and type MONITOR. Enter the following (the lines will change as you press RETURN, but that shouldn't confuse you):

```
A 0B00 LDX #$41
A 0B02 TXA
A 0B03 JSR $FFD2
A 0B06 INX
A 0B07 CPX #$5B
A 0B09 BNE 0B02
A 0B0B LDA #+13
A 0B0D JMP FFD2
A 0B10 (press RETURN)
```

Disassemble to check (with D 0B00 0B0F). Now ask what the decimal equivalent of $0B00 is by typing $0B00. You'll see a value of +2816. Return to Basic with command X.

Ready? Now command SYS 2816 and see the alphabet print.

By the way, exactly the same code will run in all other Commodore machines . . . so the Commodore 128 doesn't call for a new game.

Now. . . when you've learned a little confidence, start experimenting on how to break the above rules.

SUPERMON+64

A new version of the Machine Language Monitor program Supermon has now been released; it's called SUPERMON+. There are versions available for Commodore 64 and for VIC–20.

The new Supermon is designed to closely match the commands of the built–in monitor of the Commodore 128. Users who go from one machine to another (or from C128 side to C64 side within the Commodore 128 computer) might be otherwise confused in trying to remember which commands and which formats need to be used with which monitor.

Some of the useful new features of Supermon+ are: ability to enter decimal or binary numbers anywhere within a command; memory display including ASCII equivalents; number base conversion; and a built–in "wedge" command. On this last feature, command "@" will yield disk status, and command "@,$0" (note the comma) will call up a directory listing.

Supermon+, like Supermon, is public domain and can be obtained from a variety of sources including TPUG.

COMMODORE 128 Memory Maps: Important Locations

Jim Butterfield, Toronto, Ontario

(Abridged: August 15/85)

These maps apply to the machine when used in 128K mode. In 64 mode, the machine's map is identical to that of the Commodore 64.

There are 28 pages of overhead before the start of Basic. This brief list shows some of the more important locations.

Architecture: "Bank numbers" as used in Basic BANK and the MLM addressing scheme are misleading; in fact, they are more correctly "configuration numbers". Bank 0 shows RAM level 0, which contains work areas and the user's Basic program. Bank 1 also shows RAM, this time (for addresses above hexadecimal 0400) level 1 which contains variables, arrays, and strings. Other "banks" are really configurations, with various types of ROM or I/O overlaying RAM. Thus, bank 15 (the most popular) is ROM and I/O covering RAM bank 0. Bank 14, however, is ROM and the character generator overlaying RAM bank 0. Architecture is set so that addresses below $0400 reference bank 0 only. Other bank switching (more complex than the simplified 16-bank concept) is accomplished via storing a mask to address $FF00, or calling up pre-stored masks by writing to $FF01-FF04.

All Banks:

Hex	Decimal	Description
0000 - 0001	0-1	I/O port, similar to C64
000F	15	Type: FF = string; 00 = numeric
0010	16	Type: 80 = integer; 00 = floating point
0015	21	Current I/O prompt flag
0016 - 0017	22-23	Integer value
002D - 002E	45-46	Pointer: start-of-BASIC (for bank 0)
002F - 0030	47-48	Pointer: start-of-variables (bank 1)
0031 - 0032	49-50	Pointer: start-of-arrays
0033 - 0034	51-52	Pointer: end-of-arrays
0035 - 0036	53-54	Pointer: string-storage (moving down)
0039 - 003A	57-58	Pointer: limit-of-memory (bank 1)
003B - 003C	59-60	Current BASIC line number
003D - 003E	61-62	Textpointer: BASIC work point
0041 - 0042	65-66	Current DATA line number
0043 - 0044	67-68	Current DATA address
0047 - 0048	71-72	Current variable name
0049 - 004A	73-74	Current variable address
0063	99	Accum#1: exponent
0064 - 0067	100-103	Accum#1: mantissa
0068	104	Accum#1: sign
006A - 006F	106-111	Accum#2: exponent, and so on
0070	112	Sign comparison, Acc#1 versus #2
0071	113	Accum#1 lo-order (rounding)
007D - 007E	125-126	BASIC pseudo-stack pointer
0090	144	Status word ST
0091	145	Keyswitch IA: STOP and RVS flags
0098	152	How many open files
0099	153	Input device, normally 0
009A	154	Output CMD device, normally 3
009D	157	I/O messages: 192 = all, 64 = errors, 0 = nil
00A0 - 00A2	160-162	Jiffy Clock HML
00AE - 00AF	174-175	Tape end adds/End of program
00B7	183	Number of characters in file name
00B8	184	Current logical file
00B9	185	Current secondary address
00BA	186	Current device
00BB - 00BC	187-188	Pointer to file name
00C0	192	Tape motor interlock
00C8 - 00CB	200-203	RS-232 input/output buffer addresses
00CC - 00CD	204-205	Keyboard decode pointer (bank 15)
00D0	208	Number of characters in keyboard buffer
00D1	209	Number of programmed chars waiting
00D3	211	Key shift flag: 0 = no shift
00D5	213	Last key code: 88 if no key
00D6	214	Input from screen/from keyboard
00D7	215	40/80 columns: 0 = 40 columns
00D9	217	Character base: 0 = ROM, 4 = RAM
00E0 - 00E1	224-225	Pointer to screen line/cursor
00E2 - 00E3	226-227	Color line pointer
00E4 - 00E7	228-231	Screen margins: bottom, top, left, right
00E8 - 00E9	232-233	Input cursor log (row, column)
00EB	235	Position of cursor on screen line
00EC	236	Row where cursor lives
00FA - 00FF	250-255	UNUSED
0100 - 01FF	256-511	Processor stack area
0100 - 013E	256-318	Tape error log
0100 - 0124	256-292	DOS work area
0125 - 0138	293-312	PRINTUSING work area
0200 - 02A0	512-672	BASIC input buffer
02A2 - 02AE	674-686	Bank peek subroutine
02AF - 02BD	687-701	Bank poke subroutine
02BE - 02CC	702-716	Bank compare subroutine
02CD - 02E2	717-738	JSR to another bank
02E3 - 02FB	739-763	JMP to another bank
02FC - 02FD	764-765	Function execute hook
0300 - 0311	768-785	BASIC links
0312 - 0313	786-787	Unused
0314 - 0315	788-789	IRQ vector
0316 - 0317	790-791	Break interrupt vector
0318 - 0319	792-793	NMI interrupt vector
031A - 032D	794-813	Kernal vectors
032E - 033D	814-829	Kernal links
033E - 0349	830-841	Keyboard matrix shift vectors
034A - 0353	842-851	Keyboard buffer
0354 - 035D	852-861	Tab stop bits
035E - 0361	862-865	Line wrap bits
0362 - 036B	866-875	Logical file table
036C - 0375	876-885	Device number table
0376 - 037F	886-895	Secondary address table
0380 - 039E	896-926	CHRGET subroutine
0386	902	CHRGOT entry
039F - 03D1	927-938	Subroutines to fetch from RAM banks
03DF	991	Accum#1: Overflow
FF00	65280	MMU configuration register
FF01 - FF04	65281-65284	MMU load config registers

Bank 0:

0400 - 07E7	1024-2023	40-column screen memory
07F8 - 07FF	2040-2047	Sprite identity area (text)
0800 - 09FF	2048-2559	BASIC pseudo-stack
0A00 - 0A01	2560-2561	Vector: Basic restart
0A05 - 0A06	2565-2566	Bottom of memory pointer
0A07 - 0A08	2562-2563	Top of memory pointer
0A18	2584	RS-232 receive pointer
0A19	2585	RS-232 input pointer
0A1A	2586	RS-232 transmit pointer
0A1B	2587	RS-232 send pointer
0A20	2592	Keyboard buffer size
0A22	2594	Key repeat: 128 = all, 64 = none
0B00 - 0BBF	2816-3007	Cassette buffer
0C00 - 0DFF	3072-3583	RS-232 input, output buffers
0E00 - 0FFF	3584-4095	System sprites (56-63)
1000 - 10FF	4096-4351	Programmed key lengths and definitions
117A - 117B	4474-4475	Float-fixed vector
117C - 117D	4476-4477	Fixed-float vector
11E9 - 11EA	4585-4586	Light pen values, X and Y
1200 - 1201	4608-4609	Previous Basic line number
1202 - 1203	4610-4611	Pointer: Basic statement for CONT
1204 - 1207	4612-4615	PU characters (,.$)
1208	4616	Error type ER
1209 - 120A	4617-4618	Error line number EL
1210 - 1211	4624-4625	End of Basic (Bank 0)
1212 - 1213	4626-4627	Basic program limit [FF00]
1218 - 121A	4632-4634	USR program jump
121B - 121F	4635-4639	RND seed value
2000 - 3FFF	8192-16383	Screen memory (hi-res)
4000 - FBFF	16384-64511	BASIC RAM memory (hi-res)

Bank 1:

0400 - FBFF	1024-64511	Basic variables, arrays, strings

Bank 14: Same as Bank 15, below, except:

D000 - DFFF	53248-57343	Character generator ROM

Bank 15:

4000 - CFFF	16384-53247	ROM: BASIC
D000 - D030	53248-53296	40-col video chip 8564
D400 - D41C	54272-54300	SID sound chip 6581
D500 - D50A	54528-54538	MMU 8722 memory setup registers
D600 - D601	54784-54785	80-column CRT contr 8563
D800 - D8E7	55296-56295	Color nybbles
DC00 - DC0F	56320-56336	CIA 1 (IRQ) 6526
DD00 - DD0F	56576-56591	CIA 2 (NMI) 6526
DF00 - DF0A	57088-57098	DMA controller
E000 - FEFF	57344-65279	ROM: Kernal
FF05 - FFFF	65285-65535	ROM: Transfer, Jump Table

MIDI – Musical Instrument Digital Interface

Richard Evers, Editor

The idea started slow, but rapidly picked up speed.

Throughout the ages, man has always strived for new and exiting ways in which to amuse himself. Man is the master amuser. One way in which amusement was found, and still is today, is with music. In the beginning, there is a hint that the first musical instruments were rocks, producing a somewhat pleasing sound when smashed together in whatever unison they could muster. Soon, wood was found to possess the enthralling capacity to produce various sounds when struck. As time passed, man developed the art of cutting and forming pieces of wood to produce other truly unique sounds. From this simple beginning, we now have every instrument from the bongo drum to the grand piano. Over thousands of years of patient evolution, man has developed the most beautiful art of all – music.

This unique beginning is a primer to enable you to gain easy entrance into todays world of digital music synthesis, a world far removed from what music has been in past. Although the music synthesizer is capable of cloning the sounds of all man made instruments, it also has the ability to allow or disallow the limitations imposed on the instrument by mans capabilities. With a statement sure to be written off as sheer personal judgement, I will state that the finest of todays music synthesizers are capable of mimicking the sounds of man made instruments to such an extent that the synthetic counterpart will be preferred. But, as with all new concepts, many people will strive to retain the older, more familiar yet less refined methods of past.

Today, in what is known as the age of the microprocessor, the true "State Of The Art" (what does that mean?) phase of our existence, analog systems still persist in great numbers. Although the digital movement has taken all forms of music reproduction by storm, ie. the compact disk, digital recorded record albums and, of course, music sythesis, analog is still with us. Time will be the sole test of our loyalty to a friend long past its prime. Achieving results that were once thought impossible using analog logic now appear common place due the advent of todays digital high technology. But, justly enough, within a few years travel, our current high tech will also be considered obsolete. The sad fate of time. Obsolescence.

To get on track, a few years ago, when digital synthesis was beginning to reach its apex, a very obvious road block materialized. There were no standards to meet, no industry standard that would allow various components to be easily connected together for use. The manufacturers were producing terrific products, but the buyer was restricted to one name brand for add ons. A restricting situation.

To solve this problem, a few key people in the music sythesis industry started thinking, talking, and attracting attention along this line. The idea started slow, but rapidly picked up speed. MIDI, The Musical Instrument Digital Interface, was the solution presented to combat this problem.

The MIDI system is a series of guidelines that manufacturers should meet in order to ensure the compatibility of their products with others. As with all set guidelines, MIDI is not perfect and does actually impose limitations at times. Without coming down too hard at first, let me explain the guidelines.

The system is based on the almost current 8 bit technology, mainly because the designers were trying to produce a system that would easily fit into the budget of most starving artists. They chose a universal cable connection of the 5 pin DIN plug, using only 3 of the 5 pins. Pin #2 is ground, with pin #'s 4 and 5 being used for a current loop.

" The interface operates at 31.25 kilobaud (±1%), asynchronous, with a start bit, 8 data bits (D0 to D7), and a stop bit. This makes a total of 10 bits for a period of 320 microseconds per serial byte. "

The above paragraph was lifted directly from the MIDI 1.0 Specifications, Document No. MIDI–1.0, Dated August 5, 1983.

With each MIDI equipped unit, you will notice either two or three connectors for MIDI use. There is the MIDI In, MIDI Out, and possibly, MIDI Through (American spelling Thru). MIDI In is the connector for data coming into the unit from other MIDI equipped units on line. This can include drum and rhythm machines, extra keyboards, electric guitar and drum interfaces, controllers and sequencers, or extra synthesizers.

A total of 16 channels, numbered 1 through 16, are allowed under MIDI but more than 16 instruments can be on line at any one time. By assigning duplicate channel numbers to units, or having some units respond to all messages (see Omni Mode), vast numbers of units can be serviced. One main limitation to this provision is the extended line length required, which produces added line loss and a greater time delay with transmitted and received data. By reading more than a few articles on this subject, one fact becomes apparent. When using more than a couple of MIDI units on line, noticeable delays appear in what is deemed simultaneous sound reproduction. But, I have recently read an outstanding interview with a person well qualified in the field. He stated that the time delay between units was not completely the fault of the MIDI implementation. In his opinion, the rate at which the units process the information provided leads to the noticeable time lag. Without greater experience in the subject, it is hard to take a side.

MIDI Out is the data being transmitted from the MIDI equipped unit. MIDI Through is a copy of the information currently being passed into the unit through MIDI In. This feature, if provided, gives the user the ability to slave units together. According to MIDI specs, the cable length between units cannot exceed 50 feet, using shielded, twisted cable with Pin #2 connected to the shielding at both ends.

The transmitted data is quite easy to identify. All transmitted information is 8 bits in length, with the Status bytes having the high bit set and data bytes having the high bit clear. As we will soon discuss, the Status byte has been provided to control the system. Within the Status class will be found all commands necessary to determine what the system will do, when it will do it, and how it should be done. The Data bytes are really the workers of the system. Not only do they carry information such as the note value to be played, but they also labour under the rule of the Status bytes to ensure that all commands are understood. For the purpose of this article, the eight bit byte is arranged from bits 7 to 0, with bit 7 acting as the high bit.

The charts below have been prepared to show all the possible byte values encountered while working with the MIDI system. Complete explanations will follow.

Table Of Notes Corresponding To Data Values

Expressed In Hex

	Notes											
Octave	**C**	**C#**	**D**	**D#**	**E**	**F**	**F#**	**G**	**G#**	**A**	**A#**	**B**
–	$00	$01	$02	$03	$04	$05	$06	$07	$08	$09	$0A	$0B
0	$0C	$0D	$0E	$0F	$10	$11	$12	$13	$14	$15	$16	$17
1	$18	$19	$1A	$1B	$1C	$1D	$1E	$1F	$20	$21	$22	$23
2	$24	$25	$26	$27	$28	$29	$2A	$2B	$2C	$2D	$2E	$2F
3	$30	$31	$32	$33	$34	$35	$36	$37	$38	$39	$3A	$3B
4	$3C	$3D	$3E	$3F	$40	$41	$42	$43	$44	$45	$46	$47
5	$48	$49	$4A	$4B	$4C	$4D	$4E	$4F	$50	$51	$52	$53
6	$54	$55	$56	$57	$58	$59	$5A	$5B	$5C	$5D	$5E	$5F
7	$60	$61	$62	$63	$64	$65	$66	$67	$68	$69	$6A	$6B
8	$6C	$6D	$6E	$6F	$70	$71	$72	$73	$74	$75	$76	$77
9	$78	$79	$7A	$7B	$7C	$7D	$7E	$7F				

Status Bytes With Messages

Bit Pattern	Decimal Value	Hex Value	Data Bytes	Status Byte Message
1000 xxxx	128 to 143	$80 to $8F	2	Note Off
1001 xxxx	144 to 159	$90 to $9F	2	Note On
1010 xxxx	160 to 175	$A0 to $AF	2	Polyphonic Key Pressure
				After Touch
1011 xxxx	176 to 191	$B0 to $BF	2	Control Change
1011 xxxx	176 to 191	$B0 to $BF	2	Select Channel Mode
1100 xxxx	192 to 207	$C0 to $CF	1	Program Change
1101 xxxx	208 to 223	$D0 to $DF	1	Channel Pressure
				After Touch
1110 xxxx	224 to 239	$E0 to $EF	2	Pitch Wheel Change
1111 0000	240	$F0	variable	System Exclusive
1111 0001	241	$F1	–	Unimplemented
1111 0010	242	$F2	2	Song Position Pointer
1111 0011	243	$F3	1	Song Select
1111 0100	244	$F4	–	Unimplemented
1111 0101	245	$F5	–	Unimplemented
1111 0110	246	$F6	0	Tune Request
1111 0111	247	$F7	0	End Of Exclusive
1111 1000	248	$F8	0	Timing Clock
1111 1001	249	$F9	–	Unimplemented
1111 1010	250	$FA	0	Start
1111 1011	251	$FB	0	Continue
1111 1100	252	$FC	0	Stop
1111 1101	253	$FD	–	Unimplemented
1111 1110	254	$FE	0	Active Sensing
1111 1111	255	$FF	0	System Reset

After that unrelenting barrage of MIDI information, I feel that it is only fitting to supply you with a bit more of a detailed description. To begin, the frequency data bytes, hex values $00 to $7F, are obviously the note values as expressed through almost 10 complete octaves. This is one drawback of the system. 7 bits of resolution is not sufficient to allow graduations in smaller increments than semitones. One recent speculation made regarding this point stated that future revisions of the system specifications should allow note increments in graduations of cents, 1/100's of a semitone. A possible but difficult to implement idea.

Status Messages, in contrast to the note values, require more than a little explanation before becoming coherent to any degree. Therefore, there are two different Status messages that can be encountered. The Channel Message and the System Message.

The Channel Message

A Channel message is one that states a message and a specific unit number to which the message is addressed. The lower 4 bits, bits 0–3, are used for this identification. In the charts shown above, plus the descriptions to follow, this has been signified by the xxxx in place of the lower nibble in each appropriate bit pattern. This 4 bit channel designation also explains the limitation of this system to 16 channels (decimal range 0–15).

There are two types of channel messages; Voice and Mode. Voice messages control each separate units voices, which are sent over the voice channels. The Mode message defines the instruments response to the Voice messages, sent over the instruments basic channel. The Mode message can control such things as Local Control On and Off, All Notes Off, Omni Mode On or Off, Mono Mode On/Poly Mode Off, or Poly Mode On/Mono Mode Off. See message Select Channel Mode for more information.

The System Message

System messages are ones that do not pertain to any one specific channel. Being the elite of the system entitles them to speak and except all to listen, immediately. Within the realm of the System message falls the Common, Real–Time, and Exclusive messages.

Common messages are directed to all units, regardless of channel number. The Common messages are comprised of Song Position Pointer, Song Select, Tune Request, and End Of Exclusive. Each Common message consists of a single byte, of which an in depth explanation will follow promptly.

Real–Time messages are also intended to be heard by all units in the system, at any time, even during the transmission of other data by a Status byte. A Real–Time message is one in which can be tested for and ignored by the units, or acted upon if the information is desired. Real–Time messages are comprised of the Timing Clock, Start, Continue, Stop, Active Sensing, plus System Reset. Explanations will follow.

There is only one Exclusive Message, of which carries one Status byte, plus any length of data bytes following. It is terminated by either the Common message End Of Exclusive (EOX), or any other Status byte. An Exclusive Message is one that has been incorporated to identify the manufacturer of each piece of equipment, plus allow the manufacturer to transmit whatever message they please. A form of personalized service, finally.

Status Byte Explanations

Message:**Note Off**
Pattern: 1000 xxxx

The Note Off Message, used in conjunction with the Note On message, determine when each note will start and stop for the channel affected. Following this byte are always two data bytes. The first byte determines which note within a specific octave is to be affected, as can be demonstrated in the note chart above. The second byte is the Note Off Velocity. This value is used in synthesizers capable of ADSR (attack, decay, sustain, release), to set the rate of release from the sustained level. In synthesizers not so enabled, the release is immediate.

Message:**Note On**
Pattern: 1001 xxxx

As specified above, the Note On command is used to determine which note is stuck on a specified channel. The Note On Velocity, the second data byte, has a unique use this time. It determines the loudness setting of the note value struck. In units capable of ADSR, this level of loudness will be attained within a user predetermined time limit. If the unit is incapable of ADSR, the level will be reached immediately. The maximum loudness setting, considering we are working with the lower 7 of 8 bits, is a decimal value of 127. A value of 0 would be the same as turning the Note Off. According to specs, a value of 1 is equivalent to "triple pianissimo", very quite. A value of 127 (maximum), is "triple forte", very loud. The middle of the scale is 64, which is somewhere between "mezzo–piano" and "mezzo–forte" – middle scale. If the unit is incapable of various velocity settings, a value of 64 is used and transmitted.

Message:**Polyphonic Key Pressure After Touch**
Pattern: 1010 xxxx

Polyphonic Key Pressure After Touch is really just what is implied. The new value of key pressure attained after touching it. If the value has been set before to reflect the key pressure exerted, and the user strikes the key once again, this new pressure must be reflected. This status byte has two data bytes following. The first byte is the note stuck, with the second value byte representing the pressure. The values of pressure range from 0, no pressure at all, to 127, bashed through the keyboard.

Message:**Control Change**
Pattern: 1011 xxxx

Control Change is a status byte that is transmitted whenever a controller mechanism is adjusted. Controller mechanisms in this context refer to foot pedals, knobs (pots), modulation wheels, sliders, and switches. Two data bytes are used after the status message to reflect this change. The first byte indicates which controller was affected, while the second byte determines the new value attained. There are four ranges allowed for various controller mechanism used, as shown below.

Value Range	Controller Type
$00 to $3F	Continuous (ie. Foot Pedals, Knobs, Modulation Wheels, Sliders)
$40 to $5F	Switches
$60 to $7A	Presently Undefined
$7B to $7F	Channel Mode Messages (see Select Channel Mode following)

The first range, Continuous, often requires a more subtle range of graduations in comparison to say a switch. Either a switch is off or on, 0 or greater than 0. Continuous devices such as a slider can graduate across the scale in as large or small increments as desired, therefore a very subtle range is required. For this reason, the Control Change message allows for three data bytes if necessary. As stated before, the first data byte determines the controller affected, with the second data byte determining the value to set. This acts as the High Byte, or increment of 256 Lower Bytes. By now you know that the third byte is the Low Byte, thereby allowing a range of 14 bits, or 16,384 graduations. The Low Byte is not mandatory, therefore it can be left off if not required.

Message:**Select Channel Mode**
Pattern: 1011 xxxx

Select Channel Mode is a unique message that allows alterations to the way a MIDI unit will respond to, and transmit MIDI channel messages. Two data bytes are used to allow this transformation, with the first data byte having a limited range of $7A to $7F. This limitation is imposed due to the fact that two different messages share the same bit pattern (see Control Change above). The second data byte is used in conjunction with the first to achieve the result desired, as shown below.

Byte 1	Byte 2	Result
$7A	$00	Local Control Off
$7A	$7F	Local Control On
$7B	$00	All Notes Off
$7C	$00	Omni Mode Off, All Notes Off
$7D	$00	Omni Mode On, All Notes Off
$7E	$0x	Mono Mode On, Poly Mode Off, All Notes Off (x = number channels)
$7F	$00	Poly Mode On, Mono Mode Off, All Notes Off

The term Poly refers to Polyphonic sound reproduction, which is the ability for the unit to allow more than one note to be played simultaneously. Mono refers to Monophonic sound reproduction, which is reproduction of sound that only allows one note to be played during any one time period.

Omni is a term that is used to describe the ability for a unit to respond to all system messages, or only ones addressed to it's basic channel. When Omni is Off, the unit will only listen for messages addressed to itself. When Omni is On, it will listen and act upon every message coming over the bus.

Local Control is the ability for a unit to act through, or bypass it's own circuitry for the generation of sound. With Local Control On, the synthesizer will act like it normally does. With Local Control Off, the keyboard will still produce MIDI data as it is played, but the synthesizer will not produce any sound to compliment the data. This feature was incorporated to allow keyboards to control instruments other than the synthesizer attached.

Message:**Program Change**
Pattern: 1100 xxxx

Program Change is used with synthesizers that have banks of memory set aside for various user chosen sounds. Often times these sounds are assigned by changing the bank or patch number currently in use. Program Change allows a reflection of a change in this bank number for the channel affected, with one data byte assigned for the bank number chosen. The bank number can have a value of 0 to 127.

Message:**Channel Pressure After Touch**
Pattern: 1101 xxxx

The Channel Pressure After Touch is an interesting feature that determines the average pressure values for the unit at any instant. With this average pressure determined, a desired variation of the overall timbre value or volume of the instrument can be calculated by determining the deviation from the average required. The single data byte allowed can have a value of 0, no pressure, to 127, as much pressure as possible all around.

Message:**Pitch Wheel Change**
Pattern: 1110 xxxx

This message is one that allows a reflection of any change in the setting of the pitch wheel. As with Continuous Controller Mechanisms such as sliders, a fairly large scale is required to reflect variations in the pitch wheel setting. For this purpose, 14 bits of resolution have been provided. One odd point to note about the MIDI system specs at this point. With the Control Change message, a resolution of 14 bits was available if required. The data bytes were read High to Low. For a Pitch Wheel Change, 14 bits are also provided, but they are read Low to High. This poorly thought out variation could lead to confusion in writing code if taken for granted. So much for conventions.

Message:**System Exclusive**
Pattern: 1111 0000

A System Exclusive message is one that I find to be refreshing. It allows identification of the manufacturer, and also allows the same to get his two bits in. A System Exclusive message is comprised of the first data byte signifying the identification number assigned to the manufacturer, as per the IMA (International MIDI Association In California), and as many bytes following as the manufacturer requires to tell his story. This message is terminated either by an End Of Exclusive Message (EOX – 1111 0111), or any other Status byte that happens by. Below can be found a partial list of manufacturers ID codes, as supplied by the IMA.

Manufacturer	**ID**
Sequential Circuits Inc.	$01
Big Briar	$02
Octavew/Plateau	$03
Moog Music	$04
Passport Designs	$05
Lexicon	$06
Bon Tempi	$20
S.I.E.L.	$21
Kawai	$40
Roland	$41
Korg	$42
Yamaha	$43

Message:**Song Position Pointer**
Pattern: 1111 0010

The Song Position Pointer is a 14 bit value that allows a record to be kept of the number of beats since the start of a song session. This has been incorporated for use with synthesizers equipped with a sequencer (digital recorder), or for a rhythm machine. With this feature enabled, a flag can be set to allow music to be played from a specific location within the song. The two data bytes are read Low to High.

Message:**Song Select**
Pattern: 1111 0011

As with the Song Position Pointer, Song Select is also meant to be used with synthesizers equipped with a sequencer, or for a rhythm machine. Song Select uses one data byte to select which song or note sequence is to be played after a Start message has been received.

Message:**Tune Request**
Pattern: 1111 0110

Tune Request is a throw back into the age of Analog synthesizers. This single Status byte, no data bytes, is used to request a tuning of the Analog synthesizers oscillators.

Message:**End Of System Exclusive (EOX)**
Pattern: 1111 0111

The EOX message is a single Status byte, no data bytes, that flags when a System Exclusive Message has been completed.

Message:**Timing Clock**
Pattern: 1111 1000

The Timing Clock Message is one that can be used to synchronize all sequencers and/or rhythm machines on line. The clock transmits its message at a rate of 6 messages per beat. As stated earlier, this type of message will appear at a regular intervals, regardless of the current state of other Status messages.

Message:**Start**
Pattern: 1111 1010

As before, this Status message is intended for use with a synthesizer equipped with a sequencer or rhythm machine. This message will inform the sequencer/rhythm machine to begin playing a pre–arranged song or note sequence from the beginning. There is only one Status Byte, no data bytes, for this message. See the Song Select Message for a little more information regarding Start.

Message:**Continue**
Pattern: 1111 1011

As before, the Continue message has been incorporated for use with synthesizers equipped with a sequencer or rhythm machine. This message is used to restart the current song sequence after receiving the next Timing Clock message. The sequence is then picked up from the next position in the Song Position Pointer. This message is flagged by the user pressing the Continue button on the sythesizer. As before, this message carries one Status byte and no data bytes.

Message:**Stop**
Pattern: 1111 1100

Again, the Stop message is for synthesizers equipped with a sequencer or rhythm machine. When received, this message tells the sequencer to stop playing its current sequence. This message carries one Status byte and no data bytes.

Message:**Active Sensing**
Pattern: 1111 1110

This message is one that is transmitted by any MIDI instrument on line, powered up, but not actively involved in anything. This message is transmitted once every 300 milliseconds if

there is no activity on the MIDI bus. One Status byte and no data bytes.

Message:**System Reset**
Pattern: 1111 1111

The System Reset message performs exactly as you might expect. It tells all MIDI instruments on line to perform a power up sequence to return them to a freshly powered up state.

Retrospect

The MIDI system, as has been expressed throughout this article, is a series of well thought of specifications. Through each manufacturers implementation, musicians can use instruments of different origin and expect predictable results. This is the basic flaw in the industry today. MIDI on paper appears quite explicit in its goals. But soon after implementation, the manufacturers discovered many minute points not completely taken into consideration by MIDI Version 1.0. Today, it is this problem that confronts every musician who considers the step into the world of music synthesis.

In partial explanation, manufacturers immediately found problems implementing MIDI 1.0 following its release. Although each manufacturer tried their best to work the MIDI system within the boundaries of their machines, hindsight informed us of the inevitable. The manufacturers did not work together to make sure the systems were compatible. Each operated within their own collective vacuum, producing equipment meeting untested specifications, without considering the fact that MIDI 1.0 might be vague enough to allow multiple interpretations.

When the first MIDI machines were released on the market, problems became apparent immediately. Although many of the machines were compatible, some subtle to extreme cases of incompatibility did exist. And, as with any manufacturer faced with high R&D costs, plus further misinterpretations, many of the problems went unresolved. Take for example the Yamaha DX7 music synthesizer. It's a great machine, yet its MIDI implementation is not completely compatible with say a Roland or a Korg. In this relatively new field of digital music synthesis, it is not hard to find people who have personally become victims in this rush to compatibility.

Although I may appear to hold conflicting opinions regarding the MIDI, this is not so. MIDI in general does have its fine points. But I think that it is time for the manufacturers to get together and try to work their problems out. The specifications do not have to be altered just yet, just clarified down to the finest detail. Following this, each manufacturer can regroup to produce low cost true MIDI updates for the machines currently out. The longer this move is neglected, the greater the chance of more permanent problems. So much for a bit of sage advice.

In Summation

In closing, I would like to reflect on possible extensions to the MIDI 1.0 specifications. Due to the fact that 16 and 32 bit chips have dropped in price, implementations using these chips could be considered. With these chips, high speed communications, multi tasking, and unbelievable control over vast amounts of RAM and ROM could be taken advantage of. Further to this, we have had a chance to work with the MIDI 1.0 for quite a while now. This time of reflection has enabled musicians from all over to discover most of the weak points inherent in the system. With these points in mind, plus the technology available to us today, a true implementation could be performed, with one problem. The market has already been flooded with MIDI 1.0 equipped units. A revision at this stage would make everything else obsolete, as far as current thought allows. Due to this single fact, the MIDI specifications will not be allowed revision on a radical scale for some time to come. Although it may be hard to accept this twist of fate, the human side of this story requires consideration. Musical technology is slated to stagnate for the next few years, after which time will come an age of radical change. What our dreams are composed of today is the reality of tomorrow.

Finally, I would like to thank a few people who have helped me understand MIDI more than I ever thought possible. They include Vera Barycky, who supplied me with vast amounts of hard to get information that otherwise would be inaccessible. My father, Ted Evers, for his continuous stream of information and knowledge, and my brother, John Evers, for all his related experience working within the field, from which I was able to extract some particularly critical information.

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Computing Now	December 1984
A stack of IMA newsletters	by the IMA in California

Real–World Interfacing With The REL64 Cartridge

James E. LaPorte
Blacksburg, VA

Dr. LaPorte is Assistant Professor of Industrial Arts at The Virginia Polytechnic Institute and State University. M.Ed.

Sooner or later, there becomes an overwhelming desire among most computer enthusiasts to connect their machine to the outside world and control lights, motors, and other devices. The recent increase in articles devoted to this subject in virtually all computer publications is evidence of such a desire. On the other hand, many of these articles require at least some knowledge of electronic components, the ability to prepare printed circuit boards, and perhaps even a moderate knowledge of electronic theory. In addition, it takes a bit of bravery to connect the prescribed hardware to the computer, anticipating ruining the system due to an error.

There is a product that has been available for over two years that reduces some of the above problems. Originally called the VIC–REL, it is now called the REL 64 Relay Cartridge and is marketed by Handic Software, Inc. (400 Paterson Plank Rd., Carlstadt, NJ 07072 – $39.95 U.S.). The cartridge plugs into the user port and is compatible with any Commodore computer that has one.

Details of the Cartridge

As illustrated in Figure 1, there are a series of terminal screws on the end of the cartridge to which wires can be attached. The first six pairs of terminals (nos. 1–12) are equivalent to the terminals on six simple switches. Thus, six separate output devices can be controlled.

In addition, the cartridge is capable of detecting input from two separate sources. This is accomplished by sensing the presence or absence of 5 volts d. c. across terminal pairs 17–18 or 19–20. Though care must be taken to avoid short circuits, this voltage can be obtained from the power supply of the computer across terminals 14 and 15. Terminals 13 and 16 are unused.

Programming for Output

Only two memory locations need to be accessed to use the REL 64 cartridge. Though the specific locations for the Commodore 64 will be given as examples, the equivalent locations for the VIC–20, Plus 4, and other models with a user port can be readily found in programming reference guides.

The first of these locations is the data direction register (DDR) for the user port, 56579 decimal. When a bit at the user port is to be used for output, the operating system in the computer requires that the corresponding bit in the DDR be set high (on). Likewise, if a bit is to be used for input, the corresponding bit in the DDR is set low (off). The cartridge uses the first six bits to control the switch terminals, thus they are outputs from the computer. The remaining two bits are input. So, to configure the user port in a manner consistent with the cartridge, the number 63 is POKEd into the DDR, turning the first six bits on.

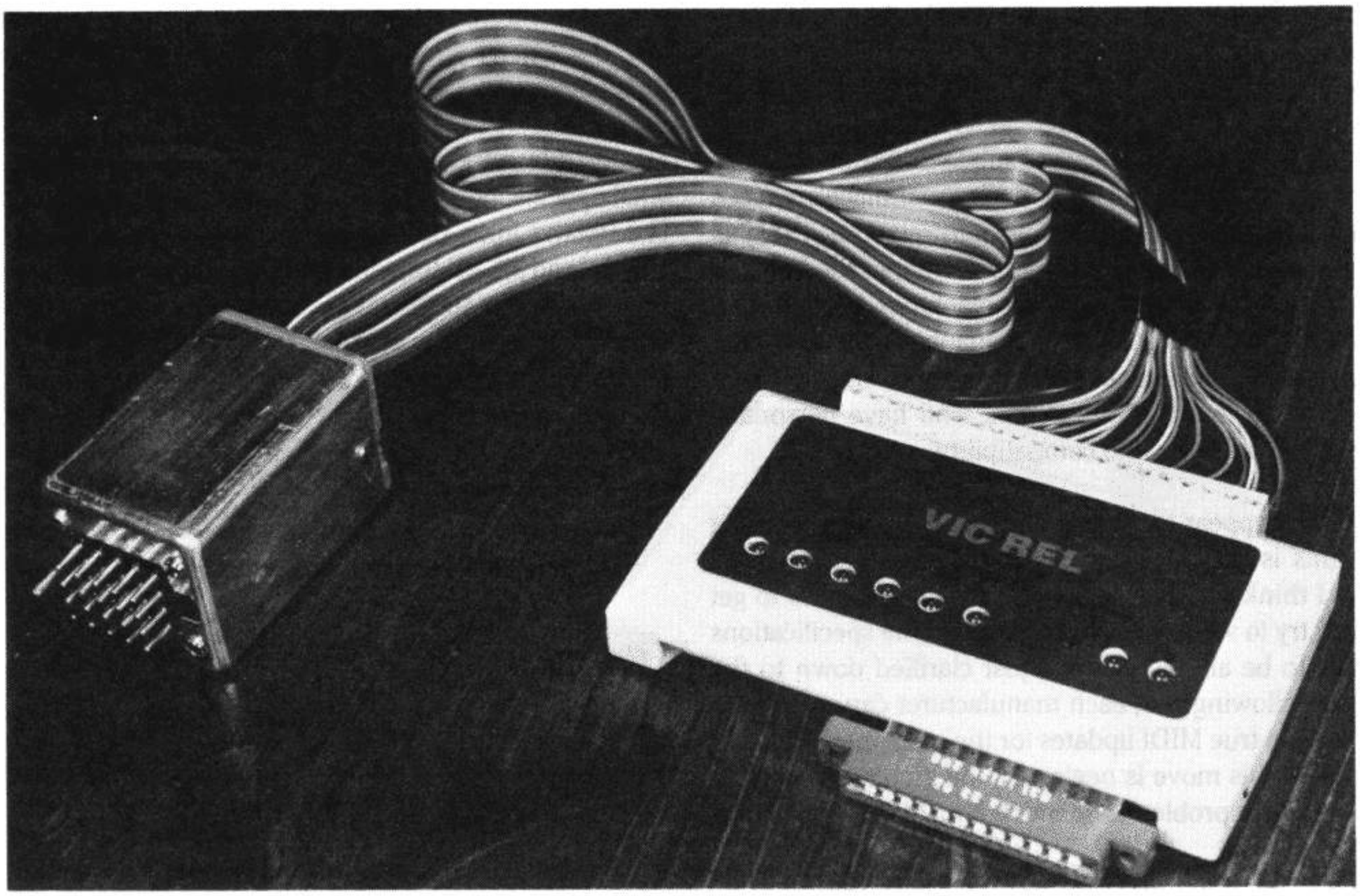


Figure 1. The VIC–REL (REL 64) Cartridge with Ribbon Cable and Discarded Telephone Connector Attached.

Once the port has been properly configured, control of output is accomplished by setting the appropriate bit at the user port (data port B) high. On the C64, this is decimal 56577. For example, if a 1 is POKEd into this location, the first bit is turned on and there will be electrical continuity between terminal screws 1 and 2 of the cartridge. Thus, a light bulb or similar device with one side of the supply in series with these terminals (like a switch) would be turned on. Likewise, a 2 POKEd into 56577 would turn on the second bit and provide electrical continuity between terminals 3 and 4, and so forth.

Programming for Input

The last two bits (6 and 7) of the user port are assigned for input. If a voltage between 5 and 12 volts d. c. is applied across terminals 17 and 18, then bit 6 is changed to a low state (off). If the same voltage is applied across terminals 19 and 20, then bit seven is set low. Note that this is opposite to what would normally be expected – the bit is off when voltage is applied.

To read input, the respective bit must be exclusively PEEKed so that the changing status of the other bits does not interfere. This is done by ANDing the bit during the PEEK. For example, to read the status of bit 6, the following program line would be used:

```
10 J = PEEK (56577) AND 64
```

If a zero is returned by the variable J, then the bit is off and 5 volts is present across terminals 17 and 18. If J returns a 64, then no voltage is present. Likewise, for bit 7, this line would be used:

```
20 K = PEEK (56577) AND 128
```

Variable K will return a zero if the bit is on and 128 if the bit is off.

Controlling Heavy Loads

The output capability of the 64 Relay Cartridge is designed for a maximum of 24 volts at 10 watts. Depending on the specifics of the intended application, this may be a serious limitation. There is, however, a relatively easy method to solve this problem by using a relay.

A relay is an electromagnetic switch. When current flows in the coil of the relay, it draws a contact toward it, completing an electrical circuit. Since the contacts of the relay are completely isolated from the coil, virtually any load desired can be controlled. The only requirement is that the voltage and power necessary for the coil of the relay does not exceed the maximum limits of 24 volts at 10 watts.

Radio Shack and other electronic component suppliers have a wide variety of relays that are suitable. The Radio Shack #275–218 relay, for example, has contacts that will handle a device rated at 10 amps. at 125 volts. This means the relay can control a load of up to 1250 watts (Wattage = Voltage x Amperes). On the other hand, this particular relay has a coil designed to operate on 12 volts at .075 amps. (0.9 watts) – well within the maximum limits of the cartridge.

The only problem in implementing relays is that a separate power supply for the relay coils must be used. Since the 12 volts necessary for the relay coils is quite common, a suitable supply might be found in a discarded "power pack" from a portable appliance, radio, etc. Such a supply might also be purchased from surplus electronic dealers. Of course, the power supply can be easily built with a minimum of knowledge.

Regardless of how the supply is secured, it must have sufficient power to supply the number of relays to be used. If six relays of the type referenced above are used, thus utilizing the full capability of the REL 64 Cartridge, the supply must deliver 450 milliamperes (6 times .075 amps = .450 amps).

A schematic for one relay is shown in Figure 2. As mentioned previously, up to six relays could be connected. The power supply connections would simply be extended to the additional relays and additional pairs of terminals (3&4, 5&6, etc.) on the cartridge would be connected.

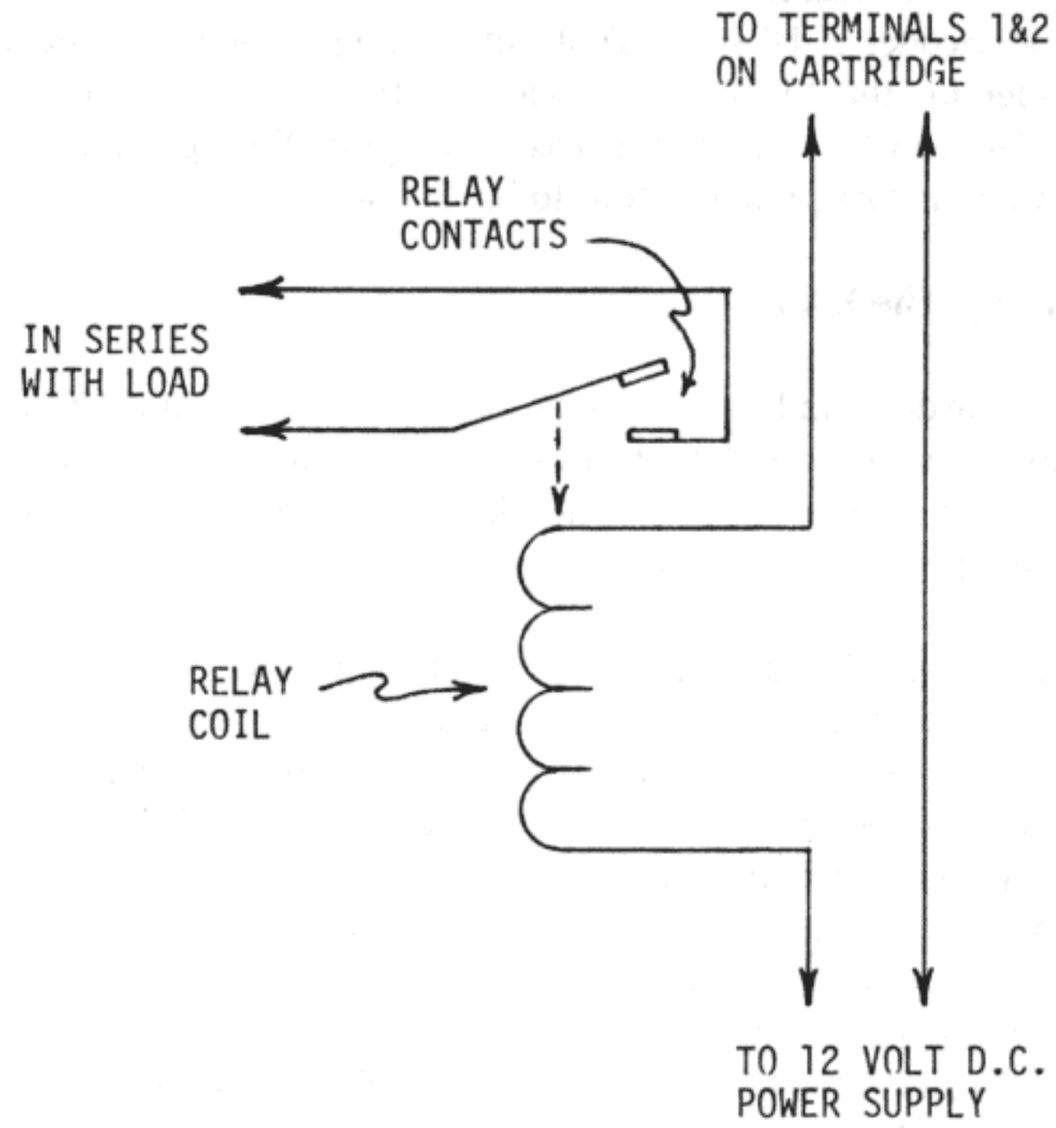


Figure 2: Schematic of connections for a relay to control heavy loads

Conclusion

The REL 64 cartridge is an easy way for a computer enthusiast to get involved in controlling real world devices with minimal knowledge of electricity. Burglar alarm systems, weather stations, model railroads, and automatic door openers are but a few of the many possible applications.

The cartridge is designed in such a way that the electrical connections are isolated from the computer. Though a gross wiring error could damage the cartridge, it cannot damage the computer. The only exception to this is the 5 volts that are available across terminals 14 and 15. Though having this voltage available makes it easy to utilize the input functions of the cartridge, care must be taken since a short across these two terminals could damage the computer.

Though the cartridge is fixed to control six outputs and sense two inputs, this should not be a major limiting factor, especially for the beginner. In addition, relays allow the development of circuits with virtually any current or voltage desired, reducing the limitation of rather low current and voltage maximums of the cartridge itself.

Several of the cartridges have been used in teaching college students the basic concepts of computer interfacing in the Industrial Arts Program Area at Virginia Tech. Even students with limited experience with microcomputers have been able to construct interesting and challenging computer–controlled projects. What is more, they seem to leave the course with a clear understanding of bits and bytes, unlike that when traditional methods are used.

1541 RAM Expander

Michael Mossman
Quispamsis, NB

Are you tired of running out of memory when writing programs for your 1541? How about a little extra room to move around in?

That's the question that got me into this problem. I started digging into the schematic diagrams of the 1541 and discovered that it had an address decoder of 1K steps. That's interesting, because the 3K ram expander for the Vic 20 is decoded in 1K steps also. These 3K expanders can be bought at a reasonable price through stores that carry Commodore products. Now to hook it up!

Installing The RAM

Turn off the drive and remove all the plugs. Remove the four screws in the bottom cover. Carefully turn over the unit and remove the top cover. Take out the two screws that hold the perforated metal cover and pull up on the screw side to remove it.

Now we need to build a bracket to hold the expander. I formed mine out of 1/16 inch aluminum stock. Figure 1 shows the mechanical details. This bracket is fastened to the front of the 1541 chassis with two 1/4 inch #48 machine screws. The chassis of the 1541 is already drilled and tapped for this size screw. (Just a note here to 1540 owners. This memory expansion can also be done to your disk drive but you will have to mount the expander externally. The reason is that you have the longer board and there is no room inside.) The 22/44 pin connector sits in the upper elbow of the bracket and is fastened with two 1 inch #48 machine screws with nuts. Thats all for the hardware, now for the wiring.

Remove the six plugs that attach to the main board and note from where they came. If necessary, mark each plug with a pen and masking tape. Remove the four screws on top that hold down the board. Next take out the two screws mounted in the side of chassis that hold down the heat sink. Now the board can be removed.

Locate on the top side of the board the 6502 microprocessor and the 7442 decoder. Turn the board over and locate the pins of these two chips. Figure 2 shows these two chips as seen from the bottom of the board. Attach 27 wires to the pins that are named. Each wire is 1.5 feet long. Take your time and make sure that you don't cause any shorts. I used ribbon cable from Radio Shack but any fine insulated wire will do. Stranded wire is best because it is less susceptible to breakage. The pins marked n/u are not used for the ram expander but could be used in normal circuit operation. The wires come out from underneath the board on the same side as the group of five plugs. I say this because it helps to angle the wires properly when you solder them to the pins. Now bring the wires out the correct side and sit the board back in place.

Connect the wires name for name from the board to the 22/44 pin connector (Figure 3). Shorten wires to the appropriate length. Connect all pins on the connector marked "GND" together. Now it should be all hooked up. Take the time to check the wiring for shorts and routing. Double check it. Remember that it is your disk drive! Reassemble the drive in reverse order from when taken apart. The perforated metal cover will not go back on as it is. It can either be left off or the front flap can be removed. Remember to insert the ram expander into the connector.

There it is all done. You now have 3K of ram added to your 1541.

RAM1	$0800–$0BFF
RAM2	$0C00–$0FFF
RAM3	$1000–$13FF

The nice thing about this added memory is that it will never be used by the operating system unless you tell it to. You also have a safe area to place a program when you start up your drive and it can be called at a later time. (Note–the VIC–1211 Super Expander can also be used but the +5 volts to the rom chip will have to be disconnected.)

Some Applications

I have included two programs to use this extra area. The first program is a little thing that creates an extra sector header on any track. You can use this as security for a disk. The next program creates three extra tracks on a disk. This creates a type of security or a safe area to hide things on a disk. With a few changes this program can be used to reformat any or all tracks. Each program has a basic part (runs in the VIC–20 or C64) and a machine language part (runs in the 1541).

I used PAL to assemble the programs to disk (sorry VIC users) and Chris Johnsen's program (See "DOS File Executor" in The Transactor, Volume 6 Issue 1) to create an "&:execute" file of the M.L. programs. If you have the DOS Exec filer program, this method is highly recommended, since the drive will be able to automatically load and run the machine language programs. Alternatively, The M.L. programs can be converted into data statements and "M–W" can be used to poke them into 1541 memory. I had to make a couple of changes to Chris's program to handle the extra memory but his routine is excellent and should be on everyone's utility disk. The changes I made to Chris's program are given in Listing 4.

With the extra RAM at your disposal, the 1541 becomes much more flexible to an enterprising programmer. How about a disk that can read and write to 4040 disks? What about a completely hidden directory? Enough of that, now for the program listings.

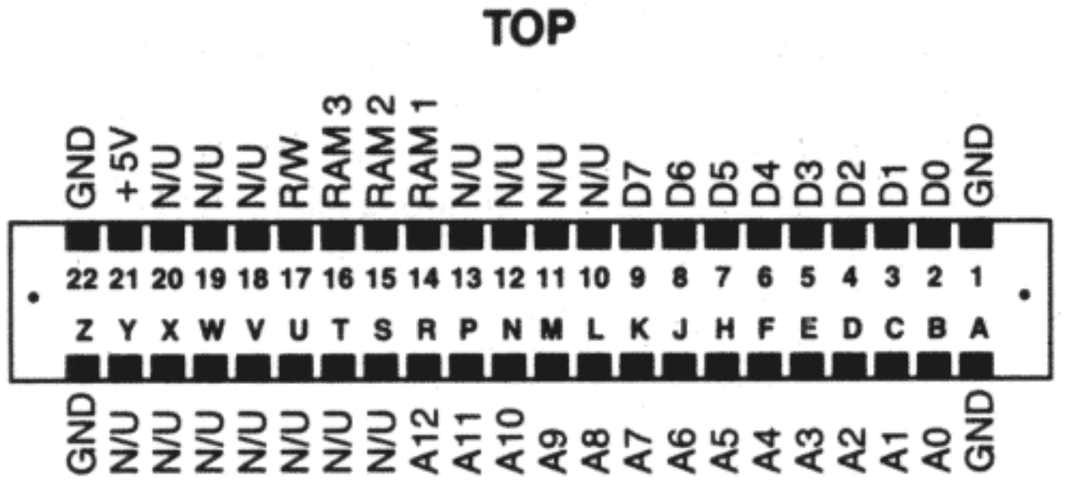


Figure 3: Rear of 22/44 pin connector that is mounted to the bracket Radio Shack Part # 276 – 1551

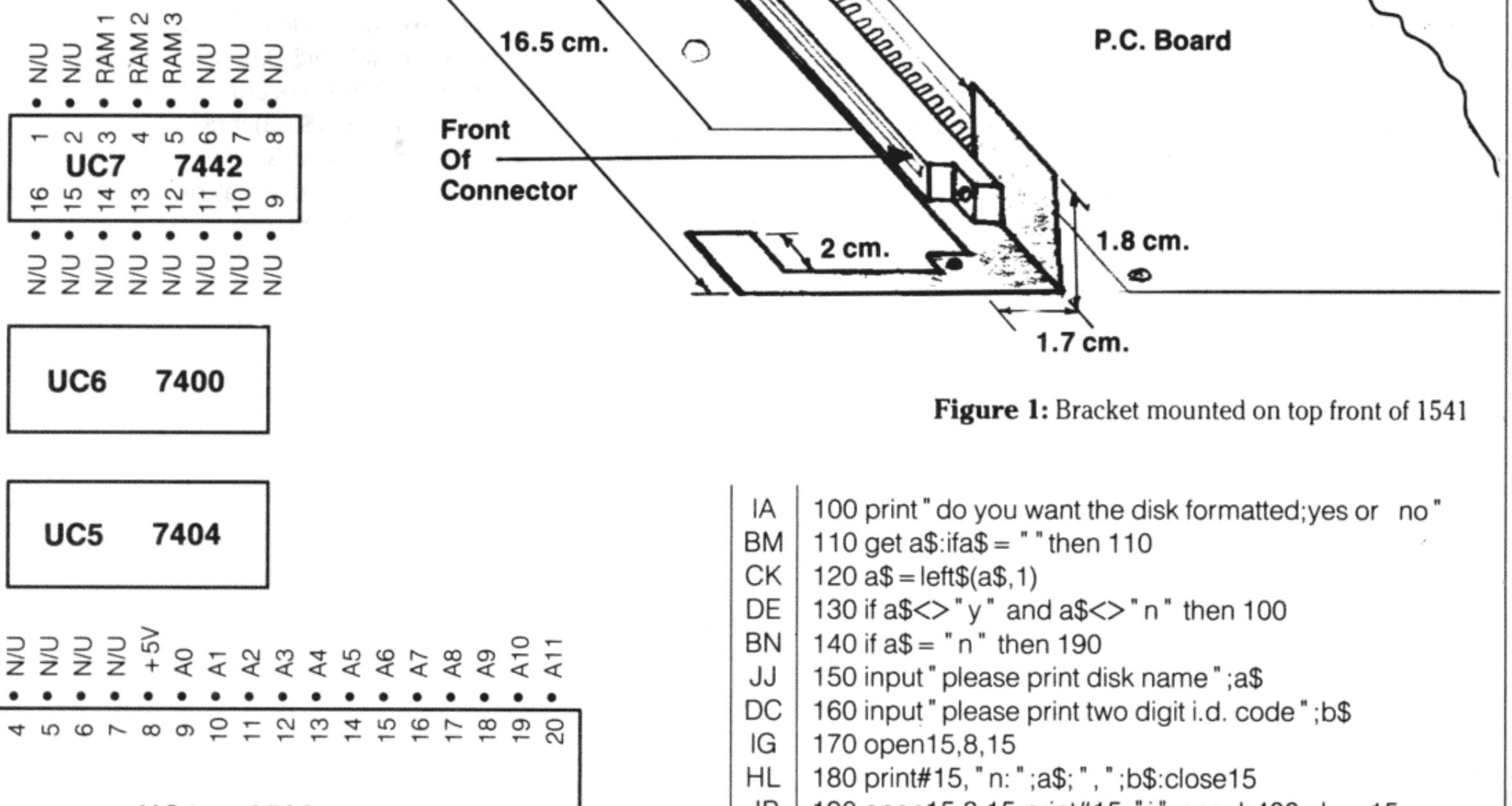


Figure 1: Bracket mounted on top front of 1541

Figure 2: Showing UNDERSIDE of 1541 Main Board (partial view)

Listing 1

BASIC program which uses the program in 1541 RAM (Listing 2) to create an extra header block on any track. Lines 30–50 load the program into drive memory using the "DOS Executor" feature. Delete these lines if using the loader in Listing 2 to put the program into drive memory.

```
AD  10 rem*******this program creates an extra
        header block on any track**********
DG  20 rem*******it does not create a data
        block for the extra header block*******
MN  30 open15,8,15
CL  40 print#15,"&:extra header"
PP  50 forx=0to4000:next:close15
IM  60 print"please insert disk to have extra sector
        header block added and press";
KG  70 print" return."
IB  80 get a$:if a$=""then 80
DB  90 if a$<>chr$(13) then 80
```

```
IA  100 print"do you want the disk formatted;yes or  no"
BM  110 get a$:ifa$=""then 110
CK  120 a$=left$(a$,1)
DE  130 if a$<>"y"and a$<>"n"then 100
BN  140 if a$="n"then 190
JJ  150 input"please print disk name";a$
DC  160 input"please print two digit i.d. code";b$
IG  170 open15,8,15
HL  180 print#15,"n:";a$;",";b$:close15
JP  190 open15,8,15:print#15,"i":gosub400:close15
IL  200 input"what track do you want the extra
        header block on,1-35";c
FI  210 ifc<1 or c>35 then 200
BP  220 ifc>0 and c<18 then d=21
CL  230 ifc>17 and c<25 then d=19
JK  240 ifc>24 and c<31 then d=18
HL  250 ifc>30 and c<36 then d=17
CM  260 open15,8,15
CD  270 print#15,"m-w"chr$(254)chr$(19)chr$(02)
        chr$(c)chr$(d)
OL  280 gosub 400
ON  290 e=d-1:count=0
JE  300 print#15,"m-w"chr$(00)chr$(04)chr$(03)chr$(76)
        chr$(03)chr$(08)
MN  310 gosub 400
LH  320 print#15,"m-w"chr$(08)chr$(00)chr$(02)
        chr$(c)chr$(e)
AP  330 gosub 400
CO  340 print#15,"m-w"chr$(01)chr$(00)chr$(01)chr$(224)
EA  350 gosub 400
HM  360 if f$="00"then print"done,all ok":close15:end
NC  370 if count=10 then 390
OM  380 count=count+1:go to 300
NJ  390 gosub 400:goto 420
NO  400 input#15,f$,g$,h$,i$
CH  410 if f$="00"then return
DJ  420 print f$,g$,h$,i$,"failed"
PI  430 close15:end
```

Listing 2.

The BASIC loader for the "header block" machine code. This program will put the program directly into the new drive RAM at $0800.

```
IK  10 rem* data loader for "header block"
JH  11 rem* this puts the program directly
PL  12 rem* into 1541 expansion ram at 0800
BI  13 :
HK  20 for i=1 to 175:read a:c=c+a:next
MN  30 if c<>20663 then print "!data error!":end
BH  40 hi=8:lo=0: rem 0800 in drive memory
AK  50 restore: open 15,8,15
LA  60 for i=1 to 175: read a
IO  70 print#15,"m-w:"chr$(lo)chr$(hi)chr$(1)chr$(a)
LM  80 lo=lo+1:if lo>255then lo=0:hi=hi+1
CM  90 next i: close 15
IN  100 :
FL  1000 data  76,160,234,173,254, 19,133, 24
ID  1010 data 173,255, 19,133, 25,169,  0, 69
OK  1020 data  22, 69, 23, 69, 24, 69, 25,133
BD  1030 data  26, 32, 52,249,162,  0,181, 36
EA  1040 data 157,  0, 16,232,224, 10,208,246
FG  1050 data 173,254, 19,133,  6,174,255, 19
NA  1060 data 202,134,  7,169,  0,133, 61,133
JF  1070 data  51,133, 48,169,  6,133, 50,169
OM  1080 data   3,133, 49, 32, 16,245, 32, 86
JK  1090 data 245, 80,254,184,173,  1, 28,145
AM  1100 data  48,200,208,245,160,186, 80,254
LM  1110 data 184,173,  1, 28,153,  0,  1,200
HD  1120 data 208,244,184, 80,254,184,173,  1
MH  1130 data  28,201, 85,240,246,173, 12, 28
IL  1140 data  41, 31,  9,192,141, 12, 28,169
DF  1150 data 255,141,  3, 28,169,255,141,  1
BO  1160 data  28,162,  5, 80,254,184,202,208
OF  1170 data 250,162,  0, 80,254,184,189,  0
OI  1180 data  16,141,  1, 28,232,224, 10,208
ON  1190 data 242,162,  9, 80,254,184,169, 85
HK  1200 data 141,  1, 28,202,208,245, 32,  0
BA  1210 data 254,169,  1, 76,105,249, 69
```

Listing 3.

The BASIC code for the C64 which will format a disk with 38 tracks. It uses the program in Listing 4 which resides in the new drive RAM. Lines 10–20 assume a "DOS Executor" file on disk; delete them if using the loader in Listing 4.

```
IM  10 open15,8,15
HA  20 print#15,"&:format 38"
CM  30 print "please insert disk to have extra tracks ";
CE  40 print "and press return."
HP  50 get a$:if a$="" then 50
CP  60 if a$<>chr$(13) then 50
JE  70 input "please print disk name";a$
DN  80 input "please print two digit i.d. code";b$
PA  90 print#15,"n:";a$;",";b$:gosub260
HP  100 count=0
EB  110 rem ;put jmp $0803 in buffer #3($0600)
LJ  120 print#15,"m-w"chr$(00)chr$(06)chr$(03)
        chr$(76)chr$(03)chr$(08)
KD  130 gosub 260
HE  140 rem ;put track 35 and sector 0 in $000c/d of
        the header table
IB  150 print#15,"m-w"chr$(12)chr$(00)chr$(02)
        chr$(35)chr$(0)
IF  160 gosub 260
EA  170 rem ;put execute code in $0003
GE  180 print#15,"m-w"chr$(03)chr$(00)chr$(01)chr$(224)
MH  190 rem ;now read the disk controller error code
ON  200 print#15,"m-r"chr$(03)chr$(00)
DH  210 get#15,er$:er=asc(er$)
PO  220 if er=01 then print "done,all ok":close15:end
IJ  230 if count=10 then 300
EE  240 count=count+1:go to 120
BC  250 gosub 260:goto 280
BG  260 input#15,f$,g$,h$,i$
GO  270 if f$="00" then return
NJ  280 print f$;g$;h$;i$;"failed"
DA  290 close15:end
CK  300 if er<17 then print "controller error #";er
CO  310 goto 250
```

Listing 4

The loader for "format38", which puts the new formatting routine into drive memory.

```
ME  10 rem* data loader for "format38"
JH  11 rem* this puts the program directly
PL  12 rem* into 1541 expansion ram at 0800
BI  13 :
OK  20 for i=1 to 752:read a:c=c+a:next
KO  30 if c<>83435 then print "!data error!":end
FC  35 print "data ok, now loading to drive ram
BH  40 hi=8:lo=0: rem 0800 in drive memory
AK  50 restore: open 15,8,15
CB  60 for i=1 to 752: read a
IO  70 print#15,"m-w:"chr$(lo)chr$(hi)chr$(1)chr$(a)
LM  80 lo=lo+1:if lo>255then lo=0:hi=hi+1
CM  90 next i: close 15
IN  100 :
AK  1000 data  76,160,234,165, 34,133, 81,169
JC  1010 data  20,141, 32,  6,169, 64,141, 33
II  1020 data   6,169, 15,141, 34,  6,169, 16
GN  1030 data 133, 67, 32,207, 10, 32,207, 10
LI  1040 data 230, 81,165, 81,201, 36,144,242
BM  1050 data  32,163,253, 32,195,253,169, 85
LL  1060 data 141,  1, 28, 32,195,253, 32,  0
CC  1070 data 254, 32, 86,245,169, 64, 13, 11
DH  1080 data  24,141, 11, 24,169, 98,141,  6
JH  1090 data  24,169,  0,141,  7, 24,141,  5
ID  1100 data  24,160,  0,162,  0, 44,  0, 28
AK  1110 data  48,251, 44,  0, 28, 16,251,173
CF  1120 data   4, 24, 44,  0, 28, 16, 17,173
CH  1130 data  13, 24, 10, 16,245,232,208,239
```

```
NH 1140 data 200, 208, 236, 169,   2,  76, 189,  10
PF 1150 data 134, 113, 132, 114, 162,   0, 160,   0
DI 1160 data 173,   4,  24,  44,   0,  28,  48,  17
BK 1170 data 173,  13,  24,  10,  16, 245, 232, 208
AC 1180 data 239, 200, 208, 236, 169,   2,  76, 189
LI 1190 data  10,  56, 138, 229, 113, 170, 133, 112
MM 1200 data 152, 229, 114, 168, 133, 113,  16,  11
GC 1210 data  73, 255, 168, 138,  73, 255, 170, 232
CK 1220 data 208,   1, 200, 152, 208,   4, 224,   4
KM 1230 data 144,  24,   6, 112,  38, 113,  24, 165
HO 1240 data 112, 109,  33,   6, 141,  33,   6, 165
OF 1250 data 113, 109,  34,   6, 141,  34,   6,  76
JF 1260 data  40,   8, 162,   0, 160,   0, 184, 173
DA 1270 data   0,  28,  16,  14,  80, 249, 184, 232
LH 1280 data 208, 245, 200, 208, 242, 169,   3,  76
KA 1290 data 189,  10, 138,  10, 141,  37,   6, 152
LG 1300 data  42, 141,  36,   6, 169, 191,  45,  11
FB 1310 data  24, 141,  11,  24, 169, 102, 141,  38
CE 1320 data   6, 166,  67, 160,   0, 152,  24, 109
NB 1330 data  38,   6, 144,   1, 200, 200, 202, 208
BG 1340 data 245,  73, 255,  56, 105,   0,  24, 109
NJ 1350 data  37,   6, 176,   3, 206,  36,   6, 170
DH 1360 data 152,  73, 255,  56, 105,   0,  24, 109
JK 1370 data  36,   6,  16,   5, 169,   4,  76, 189
LK 1380 data  10, 168, 138, 162,   0,  56, 229,  67
II 1390 data 176,   3, 136,  48,   3, 232, 208, 245
HE 1400 data 142,  38,   6, 224,   4, 176,   5, 169
NJ 1410 data   5,  76, 189,  10,  24, 101,  67, 141
GM 1420 data  39,   6, 169,   0, 141,  40,   6, 160
HJ 1430 data   0, 166,  61, 165,  57, 153,   0,   3
JA 1440 data 200, 200, 173,  40,   6, 153,   0,   3
BK 1450 data 200, 165,  81, 153,   0,   3, 200, 181
KP 1460 data  19, 153,   0,   3, 200, 181,  18, 153
FK 1470 data   0,   3, 200, 169,  15, 153,   0,   3
NC 1480 data 200, 153,   0,   3, 200, 169,   0,  89
EP 1490 data 250,   2,  89, 251,   2,  89, 252,   2
HE 1500 data  89, 253,   2, 153, 249,   2, 238,  40
DE 1510 data   6, 173,  40,   6, 197,  67, 144, 187
KC 1520 data 152,  72, 232, 138, 157,   0,   5, 232
JP 1530 data 208, 250, 169,   3, 133,  49,  32,  48
FF 1540 data 254, 104, 168, 136,  32, 229, 253,  32
MD 1550 data 245, 253, 169,   5, 133,  49,  32, 233
LE 1560 data 245, 133,  58,  32, 143, 247, 169,   0
EI 1570 data 133,  50,  32,  14, 254, 169, 255, 141
KC 1580 data   1,  28, 162,   5,  80, 254, 184, 202
DL 1590 data 208, 250, 162,  10, 164,  50,  80, 254
NL 1600 data 184, 185,   0,   3, 141,   1,  28, 200
AM 1610 data 202, 208, 243, 162,   9,  80, 254, 184
LI 1620 data 169,  85, 141,   1,  28, 202, 208, 245
CO 1630 data 169, 255, 162,   5,  80, 254, 184, 141
BH 1640 data   1,  28, 202, 208, 247, 162, 187,  80
LA 1650 data 254, 184, 189,   0,   1, 141,   1,  28
CO 1660 data 232, 208, 244, 160,   0,  80, 254, 184
NL 1670 data 177,  48, 141,   1,  28, 200, 208, 245
GP 1680 data 169,  85, 174,  38,   6,  80, 254, 184
LJ 1690 data 141,   1,  28, 202, 208, 247, 165,  50
LK 1700 data  24, 105,  10, 133,  50, 206,  40,   6
KP 1710 data 208, 147,  80, 254, 184,  80, 254, 184
NL 1720 data  32,   0, 254, 169, 200, 141,  35,   6
KP 1730 data 169,   0, 133,  48, 169,   3, 133,  49
AC 1740 data 165,  67, 141,  40,   6,  32,  86, 245
DC 1750 data 162,  10, 160,   0,  80, 254, 184, 173
OK 1760 data   1,  28, 209,  48, 208,  14, 200, 202
OG 1770 data 208, 242,  24, 165,  48, 105,  10, 133
LC 1780 data  48,  76, 126,  10, 206,  35,   6, 208
LD 1790 data 207, 169,   6,  76, 189,  10,  32,  86
AP 1800 data 245, 160, 187,  80, 254, 184, 173,   1
KC 1810 data  28, 217,   0,   1, 208, 230, 200, 208
FP 1820 data 242, 162, 252,  80, 254, 184, 173,   1
AE 1830 data  28, 217,   0,   5, 208, 214, 200, 202
OJ 1840 data 208, 241, 206,  40,   6, 208, 174, 165
NI 1850 data  81, 201,  38, 176,   3,  76,  26,   8
IK 1860 data 169, 255, 133,  81, 169,   0, 133,  80
OG 1870 data 169,   1,  76, 105, 249, 206,  32,   6
BG 1880 data 240,   3,  76,  40,   8, 160, 255, 132
NN 1890 data  81, 200, 132,  80,  76, 105, 249, 174
PF 1900 data   0,  28, 232, 138,  41,   3, 141, 255
DM 1910 data  19, 173,   0,  28,  41, 252,  13, 255
DL 1920 data  19, 141,   0,  28, 160,   5, 162, 255
LL 1930 data 202, 208, 253, 136, 208, 250,  96,  32
```

Listing 5

Changes to make to the " DOS Executor " program (July 85 Transactor) to allow it to work with the expansion RAM.

```
change line 370 print " bam buffer-1792  $0700 "
add      line 375 print " expansion ram-2048  $0800 " d$
change line 400 ifval(dm$)>7419thenprintd$d$ " not higher then
                    7419 " :printu$u$u$u$:goto380
add      line 461 ifcnt = 0thencnt = 1:goto470
add      line 462 dm = dm + 250
add      line 463 hi = int(dm/256):lo = dm-hi*256
add      line 501 ifcnt = 0thencnt = 1:goto510
add      line 502 dm = dm + 250
add      line 503 hi = int(dm/256):lo = dm-hi*256
```

```
HJ 100 rem  open1,8,1, " 0:format38.obj
EB 110 rem  save " @0:format38.pal " ,8
IP 120 sys700    ;pal 64 assembler
ML 130 blocks free.
OJ 140 this program lives inside the 1541
GK 150  and will format with 38 tracks
CL 160 it should be used with its basic
KO 170  counterpart in the c64
KC 180 ;
GC 190 .opt oo
GL 200 *        =    $0800
IE 210 ;
DL 220          jmp  $eaa0      ;cold start of disk drive
MJ 230          lda  $22        ;current track #
NE 240          sta  $51        ;track # for formating
PK 250          lda  #$14       ;set to allow 20 errors
IM 260          sta  $0620
KG 270          lda  #$40       ;set $0621/2 to 4000 as a
BN 280          sta  $0621      ;guess to the # of bytes
                                  on half a track
NJ 290          lda  #$0f
CP 300          sta  $0622
GM 310          lda  #$10       ;set to allow 16 sectors
```

```
                                    on these tracks
LA  320          sta  $43
KL  330 bigger   jsr  step      ;move head half a track
FD  340          jsr  step      ;and again
FB  350          inc  $51       ;increase track #
JM  360          lda  $51       ;if not on track 36 then
                                  move head
AP  370          cmp  #$24
DI  380          bcc  bigger
MP  390 ;
FD  400 start    jsr  $fda3     ;erase track
KF  410          jsr  $fdc3     ;write sync area
KO  420          lda  #$55
EJ  430          sta  $1c01
NO  440          jsr  $fdc3     ;write non-sync area
ME  450          jsr  $fe00     ;kill write mode
FC  460          jsr  $f556     ;wait for sync
ID  470          lda  #$40      ;set timer
MM  480          ora  $180b
AM  490          sta  $180b
BD  500          lda  #$62
IM  510          sta  $1806
DP  520          lda  #0
NN  530          sta  $1807
FO  540          sta  $1805
ED  550          ldy  #0        ;set y and x as count
HH  560          ldx  #0
JG  570 sync     bit  $1c00     ;read sync
OM  580          bmi  sync
MG  590 nonsync  bit  $1c00     ;read non-sync
NJ  600          bpl  nonsync
GF  610 reset    lda  $1804     ;reset flag
HH  620 read     bit  $1c00     ;read non-sync
GP  630          bpl  here
KB  640          lda  $180d
GH  650          asl  a
PL  660          bpl  read
KH  670          inx
HG  680          bne  reset
CJ  690          iny
LH  700          bne  reset
FL  710          lda  #2
KC  720          jmp  error
AF  730 ;
EP  740 here     stx  $71       ;store count
MB  750          sty  $72
LB  760          ldx  #0        ;set count
NE  770          ldy  #0
JI  780 reset1   lda  $1804     ;reset flag
CL  790 read1    bit  $1c00     ;read sync
AK  800          bmi  now
EM  810          lda  $180d
AC  820          asl  a
LM  830          bpl  read1
EC  840          inx
DH  850          bne  reset1
MD  860          iny
HI  870          bne  reset1
PF  880          lda  #2
EN  890          jmp  error
KP  900 ;
GK  910 now      sec            ;caculate time
ME  920          txa
PD  930          sbc  $71
HH  940          tax
OH  950          sta  $70
HH  960          tya
KG  970          sbc  $72
DK  980          tay
JK  990          sta  $71
KG  1000         bpl  pos       ;is the difference
                                  postive
KJ  1010         eor  #$ff
LM  1020         tay
KL  1030         txa
IL  1040         eor  #$ff
FO  1050         tax
AA  1060         inx
JG  1070         bne  pos
IB  1080         iny
FF  1090 pos     tya
BL  1100         bne  tryagain
BH  1110         cpx  #4        ;is the difference
                                  greater then 4
OJ  1120         bcc  ok
ND  1130 tryagain asl $70
KF  1140         rol  $71
EP  1150         clc
CB  1160         lda  $70
LA  1170         adc  $0621
BG  1180         sta  $0621
DD  1190         lda  $71
KC  1200         adc  $0622
AI  1210         sta  $0622
JN  1220         jmp  start
EE  1230 ;
AJ  1240 ok      ldx  #0        ;set counter
NC  1250         ldy  #0
OK  1260         clv
CM  1270 test    lda  $1c00     ;test for sync
HN  1280         bpl  timer
DM  1290         bvc  test
GN  1300         clv
KP  1310         inx
BN  1320         bne  test
CB  1330         iny
FO  1340         bne  test
HD  1350         lda  #3
KK  1360         jmp  error
AN  1370 ;
KJ  1380 timer   txa            ;store the count
KF  1390         asl  a
BE  1400         sta  $0625
JD  1410         tya
OI  1420         rol  a
OF  1430         sta  $0624
PI  1440         lda  #$bf      ;caculate the number of
CP  1450         and  $180b     ;bytes on this track
OD  1460         sta  $180b     ;by the number of
                                  sectors
LA  1470         lda  #$66
CJ  1480         sta  $0626
```

```
LL 1490       ldx  $43
HC 1500       ldy  #0
NJ 1510       tya
MO 1520 cac1  clc
IH 1530       adc  $0626
DL 1540       bcc  cac2
OO 1550       iny
PH 1560 cac2  iny
JN 1570       dex
AA 1580       bne  cac1
ON 1590       eor  #$ff
BM 1600       sec
HC 1610       adc  #0
KM 1620       clc
LN 1630       adc  $0625
LF 1640       bcs  cac3
HP 1650       dec  $0624
PM 1660 cac3  tax
ND 1670       tya
ID 1680       eor  #$ff
LB 1690       sec
BI 1700       adc  #0
EC 1710       clc
ED 1720       adc  $0624
EM 1730       bpl  cac4
PL 1740       lda  #4
AD 1750       jmp  error
GF 1760 ;
CE 1770 cac4  tay
IK 1780       txa
FE 1790       ldx  #0
DB 1800 cac5  sec
PK 1810       sbc  $43
LB 1820       bcs  cac6
BO 1830       dey
JC 1840       bmi  cac7
BK 1850 cac6  inx
IC 1860       bne  cac5
AA 1870 cac7  stx  $0626
JL 1880       cpx  #4
CI 1890       bcs  headers
BG 1900       lda  #5
AN 1910       jmp  error
GP 1920 ;
MN 1930 headers clc        ;set up all of the
DC 1940       adc  $43     ;headers for this track in
FG 1950       sta  $0627   ;buffer #0
DJ 1960       lda  #0
OH 1970       sta  $0628
HA 1980       ldy  #0
AO 1990       ldx  $3d
PH 2000 header1 lda $39    ;header block id
                             code ($07)
AP 2010       sta  $0300,y
PN 2020       iny          ;skip checksum
OM 2030       iny
NN 2040       lda  $0628   ;sector number
IB 2050       sta  $0300,y
MO 2060       iny
OC 2070       lda  $51     ;track number
GD 2080       sta  $0300,y
KA 2090       iny
EC 2100       lda  $13,x   ;id
EF 2110       sta  $0300,y
IC 2120       iny
PD 2130       lda  $12,x   ;id
CH 2140       sta  $0300,y
GE 2150       iny
CL 2160       lda  #$0f    ;off byte
AJ 2170       sta  $0300,y
EG 2180       iny
EK 2190       sta  $0300,y
IH 2200       iny
PK 2210       lda  #0      ;caculate checksum
OB 2220       eor  $02fa,y
MC 2230       eor  $02fb,y
KD 2240       eor  $02fc,y
IE 2250       eor  $02fd,y
LK 2260       sta  $02f9,y ;store checksum
CG 2270       inc  $0628   ;increase sector counter
GH 2280       lda  $0628
EM 2290       cmp  $43
GH 2300       bcc  header1
NL 2310       tya
MI 2320       pha
GP 2330       inx
IN 2340       txa
NG 2350 data  sta  $0500,x ;set up dummy data
                             block in
OG 2360       inx          ;buffer #2
HE 2370       bne  data
ND 2380       lda  #3
JE 2390       sta  $31     ;set buffer pointer
FO 2400       jsr  $fe30   ;convert headers to
                             gcr code
CP 2410       pla
DE 2420       tay
JD 2430       dey
CN 2440       jsr  $fde5   ;jsr moveup
CP 2450       jsr  $fdf5   ;jsr movovr
BP 2460       lda  #5      ;set buffer pointer
JG 2470       sta  $31
CE 2480       jsr  $f5e9   ;jsr chkblk-to caculate
OJ 2490       sta  $3a     ;checksum for
                             data block
IO 2500       jsr  $f78f   ;jsr bingcr-to convert
                             data block to gcr
JL 2510       lda  #0
OJ 2520       sta  $32
IJ 2530       jsr  $fe0e   ;jsr clear-to clean track
AO 2540 write lda  #$ff    ;now the track is to be
                             written out
MN 2550       sta  $1c01
KF 2560       ldx  #5      ;write out 5 sync marks
PB 2570 wait1 bvc  wait1
GN 2580       clv
FN 2590       dex
OJ 2600       bne  wait1
PI 2610       ldx  #$0a    ;10 bytes for
                             each header
IC 2620       ldy  $32     ;set y to header pointer
CG 2630 wait2 bvc  wait2
```

```
PK 2640          clv          ;write out header
CD 2650          lda  $0300,y
KE 2660          sta  $1c01
OE 2670          iny
PC 2680          dex
KP 2690          bne  wait2
HE 2700          ldx  #9      ;header gap size
JL 2710 wait3    bvc  wait3
CG 2720          clv
PE 2730          lda  #$55    ;header gap
KJ 2740          sta  $1c01
FH 2750          dex
CE 2760          bne  wait3
GO 2770          lda  #$ff    ;sync mark
AA 2780          ldx  #5      ;sync size
AB 2790 wait4    bvc  wait4
CL 2800          clv
AO 2810          sta  $1c01
LL 2820          dex
KI 2830          bne  wait4
DI 2840          ldx  #$bb    ;overflow buffer - write
                                data block
DF 2850 wait5    bvc  wait5
OO 2860          clv
FA 2870          lda  $0100,x
GC 2880          sta  $1c01
GC 2890          inx
CN 2900          bne  wait5
JK 2910          ldy  #0
AK 2920 wait6    bvc  wait6
ED 2930          clv
FB 2940          lda  ($30),y ;buffer #2
MG 2950          sta  $1c01
AH 2960          iny
KB 2970          bne  wait6
BJ 2980          lda  #$55    ;tail gap
BO 2990          ldx  $0626   ;number of tail
                                gap bytes
HP 3000 wait7    bvc  wait7
EI 3010          clv
CL 3020          sta  $1c01
NI 3030          dex
CG 3040          bne  wait7
CH 3050          lda  $32
KG 3060          clc
HF 3070          adc  #$0a
OM 3080          sta  $32
LJ 3090          dec  $0628
JA 3100          bne  write
MG 3110 wait8    bvc  wait8
CP 3120          clv
HI 3130 wait9    bvc  wait9
GA 3140          clv
IN 3150          jsr  $fe00   ;kill write mode
MO 3160          lda  #$c8    ;now verify track with
                                200 trys
JC 3170          sta  $0623
JA 3180 try      lda  #0      ;set buffer pointer
GD 3190          sta  $30
BH 3200          lda  #3
NE 3210          sta  $31
BJ 3220          lda  $43     ;num of sectors on
                                this track
KG 3230          sta  $0628
NI 3240 cont     jsr  $f556   ;wait for sync
FH 3250          ldx  #$0a
HA 3260          ldy  #0
LI 3270 chk1     bvc  chk1
CJ 3280          clv
CI 3290          lda  $1c01
CP 3300          cmp  ($30),y ;check header
AE 3310          bne  error1
IN 3320          iny
JL 3330          dex
GA 3340          bne  chk1
MI 3350          clc
CK 3360          lda  $30
DI 3370          adc  #$0a
EP 3380          sta  $30
FH 3390          jmp  more
OL 3400 ;
HJ 3410 error1   dec  $0623
BO 3420          bne  try
NF 3430          lda  #6
KM 3440          jmp  error
AP 3450 ;
LM 3460 more     jsr  $f556   ;wait for sync
GL 3470          ldy  #$bb    ;overflow buffer-we
                                are checking
BD 3480 chk2     bvc  chk2    ;the data block
EG 3490          clv
EF 3500          lda  $1c01
NM 3510          cmp  $0100,y
CB 3520          bne  error1
KK 3530          iny
CN 3540          bne  chk2
LO 3550          ldx  #$fc
HL 3560 chk3     bvc  chk3
EL 3570          clv
EK 3580          lda  $1c01
II 3590          cmp  $0500,y ;buffer #2 data
CG 3600          bne  error1
KP 3610          iny
LN 3620          dex
AD 3630          bne  chk3
NO 3640          dec  $0628   ;sector counter
OF 3650          bne  cont
EG 3660          lda  $51     ;track number
DL 3670          cmp  #$26    ;are 38 tracks done
OC 3680          bcs  done
JF 3690          jmp  bigger  ;do more tracks
KO 3700 ;
LI 3710 done     lda  #$ff    ;reset values
PE 3720          sta  $51
NH 3730          lda  #0
AG 3740          sta  $50
DB 3750          lda  #1      ;job done ok
GE 3760          jmp  $f969   ;main error handler
KE 3770 error    dec  $0620   ;error counter
NN 3780          beq  next
DO 3790          jmp  start
JD 3800 next     ldy  #$ff
```

```
JA 3810          sty  $51
MM 3820          iny
KB 3830          sty  $50
GJ 3840          jmp  $f969      ;main error handler
CG 3850 step     ldx  $1c00      ;move head half a track
AP 3860          inx
CN 3870          txa
FB 3880          and  #$03
FF 3890          sta  $13ff
DO 3900          lda  $1c00
JG 3910          and  #$fc
EI 3920          ora  $13ff
PD 3930          sta  $1c00
LP 3940          ldy  #$05
HI 3950          ldx  #$ff
NL 3960 loop1    dex             ;allow head to settle
ME 3970          bne  loop1
HE 3980          dey
AG 3990          bne  loop1
MI 4000          rts
```

```
MJ 100 open1,8,1,"0:header.obj
NB 105 rem  save"@0:header.pal",8
OO 110 sys700                    ;pal 64 assembler
OO 120 ;
EJ 130 this program lives inside the 1541
IH 140  and creates an extra header block
IK 150 it should be used with its basic
AO 160  counterpart in the c64
AC 170 ;
CM 180 .opt o1
MK 190 *        =    $0800
LG 200          jmp  $eaa0      ;reset disk drive
CF 210          lda  $13fe      ;track #;rentry from basic
AL 220          sta  $18
LF 230          lda  $13ff      ;sector #
HM 240          sta  $19
LA 250          lda  #$00       ;checksum for header
LM 260          eor  $16
HN 270          eor  $17
DO 280          eor  $18
PO 290          eor  $19
LB 300          sta  $1a
MI 310          jsr  $f934      ;convert header to gcr
PL 320          ldx  #$00
DH 330          lda  $24,x      ;store our header
KI 340          sta  $1000,x    ;image in a safe place
KD 350          inx
ND 360          cpx  #$0a
MD 370          bne  loop1
EP 380          lda  $13fe      ;set up for reading
GP 390          sta  $06        ;last sector on this track
BN 400          ldx  $13ff
BF 410          dex
PM 420          stx  $07
BN 430          lda  #$00
EL 440          sta  $3d
LI 450          sta  $33
MI 460          sta  $30
```

```
BB 470          lda  #$06
GK 480          sta  $32
JB 490          lda  #$03
HL 500          sta  $31
BK 510          jsr  $f510      ;read in header block
BG 520          jsr  $f556      ;wait for sync
KL 530          bvc  wait1      ;read in data block
ON 540          clv
OM 550          lda  $1c01
LC 560          sta  ($30),y
KB 570          iny
KL 580          bne  wait1
LE 590          ldy  #$ba
AO 600          bvc  wait2
EC 610          clv
EB 620          lda  $1c01
GI 630          sta  $0100,y
AG 640          iny
CA 650          bne  wait2
GF 660          clv
EL 670          bvc  hold       ;see if tail gap is
LK 680          clv             ;over
KF 690          lda  $1c01
HE 700          cmp  #$55
HD 710          beq  hold
KI 720          lda  $1c0c
OO 730          and  #$1f
NM 740          ora  #$c0
GO 750          sta  $1c0c
FL 760          lda  #$ff
KO 770          sta  $1c03
HB 780          lda  #$ff       ;write out 5 sync markers
MP 790          sta  $1c01
DL 800          ldx  #$05
EL 810          bvc  wait3
GP 820          clv
FP 830          dex
CM 840          bne  wait3
JM 850          ldx  #$00       ;write out extra header
JE 860          bvc  wait4      ;block that was
KN 870          clv             ;saved at $1000
OD 880          lda  $1000,x
AG 890          sta  $1c01
AG 900          inx
DG 910          cpx  #$0a
EB 920          bne  wait4
PN 930          ldx  #$09       ;write out header gap
KD 940          bvc  wait5
IH 950          clv
GA 960          lda  #$55
AL 970          sta  $1c01
LI 980          dex
MF 990          bne  wait5
EI 1000           jsr  $fe00    ;terminate write mode
MN 1010           lda  #$01     ;jump to error handler
CC 1020           jmp  $f969    ;with a job all ok
```

Assembly Language Disk Access

Richard Evers, Editor

. . .it's no more difficult than Basic, once you try it. . .

For many programming applications, disk accessing through Basic is sufficient. At times, though, the speed of Basic disk access tends to induce a neanderthal reaction within us. This transformation is one in which we all take on from time to time, and as such, it is also one that is best left hidden. The solution: write the disk access routines in assembler.

There is a stigma attached to working with the drive at a machine code level. Programmers from all walks of life will often produce code destined for greatness, yet these same programmers will shy away from taking on the drive. The 'perhaps it will bite' syndrome prevails. This article has been written to dispel all such fears and show that the rumours have been more hysteria than fact. Enough babbling, time to produce.

If we were to write a simple file read routine in Basic, it would go something like this;

```
100 input " filename " ;f$
110 open 7,8,9,(f$)
120 get#7,a$: print a$;: if st = 0 then 120
130 close 7
```

Not too difficult. Well, doing it in assembler is a bit more tedious, but easy to grasp after performing it a few times. Below is the flow of operations for the code written for this occasion.

1. Input filename from keyboard
2. Determine length of filename
3. Set-up parameters for the filename
4. Set-up logical address, secondary address, and device number
5. Open the file
6. Set input device as the file to be read
7. Read a character from disk and print it to the screen
8. Check the file status – if not the end of file, get another character (7)
9. Clear channel, close the file, and return to Basic

This is a very simple example of a sequential file read routine.

Notes On Direct Mode

If you were to assemble the source below and try to use it from direct mode, you will generate a syntax error on return to Basic. Why? Because direct mode statements are sent to the Basic input buffer for use. When a SYS statement is performed, the return address is placed on the stack, to be used when return to Basic is desired. Now the problems develop. In direct mode the SYS command will generate a return address that points right into the Basic input buffer. My examples use an Input routine to capture the desired filename. Input also uses the Basic input buffer. When the RTS is executed to return to Basic, it will land back into a pile of data it cannot understand, the filename. Instant syntax error. In program mode this will not happen since the return address will point into Basic text.

To get around this problem, a few methods exist. The first is to clear out the input buffer with zeros before returning to Basic. The next method is to retain the input buffer contents on entrance to the routine, and swap it back into the buffer before exit. A third method is to jump to a Basic warm start on exit instead of the RTS. A warm start will bring you cleanly back into direct mode Basic, irregardless of the mode in which you were working prior, direct or program mode. A thought to remember.

Procedure

In the first block of source, written for the Basic 4.0 Pet/CBM machines, you will notice that it looks a tad awkward in relation to the second block of source, written for the C64. The reason is that Commodore grew wiser, as far as programming goes, as time went by. They used their noggins and produced some really nice kernal routines to help make writing easier. In fact, my C64 source is virtually perfect for the VIC 20, with the exception of two ROM routines. The first routine, INPUT, is the Input routine, of which the address is located in the source. The second, PRTSTR, is a routine that will print a string of characters pointed to by the Y register (high byte), and the Accumulator (low byte). This routine will continue printing characters until a zero byte terminator is found. It's address can also be found listed in the source.

When you get a little better acquainted with the techniques involved, I am sure that you will be able to find quite a few shortcuts to take to produce the same effect. One shortcut is to use a Logical and Secondary address of 8. Instead of;

```
lda  #7
sta  logadd   ; set logical address
lda  #8
sta  devnum   ; set device number
lda  #9
sta  secadd   ; set secondary address
```

for the Pet/CBM, you could simply:

```
lda  #8       ; la, sa, devnum
sta  logadd
sta  devnum
sta  secadd
```

It would save all of four bytes. For the C64 version, the code:

```
lda  #7       ; logical address
ldx  #8       ; device number
ldy  #9       ; secondary address
```

could be optimized into:

```
lda  #8       ; la, sa, devnum
tax
tay
```

Saving all of two bytes. If you are willing to stoop to a level of lack of clarity and further lack of adaptability, you can save a byte here and there. But wait until you understand the code properly.

Another note that might bother you. I used a very simple method to retrieve the filename, an Input statement. If you have been reading our magazine for any length of time, you might have noticed a few really sharp routines covered in prior issues. My favourite is the method of parsing the filename as a string following the SYS address when entering the routine. For purposes of simplicity, my example shows the Input statement. For you own creations, try to find one that suits the occasion best.

Very little more requires to be said about the routine that follows. It is a simple file read routine and performs no major miracles. Perhaps, though, you want to write to a file. This might be a tad more difficult, depending on the file type desired.

The easiest would be to create a Program file on disk. To do this, change the Secondary Address used in our example to a 1. With a Secondary Address of 1, all file work automatically defaults to a write, with the created file becoming a PRG type.

As you can probably guess, this feature was incorporated to make the Saving of Basic programs a little easier. Any Secondary Address greater than 1 and less than 15 will read from a file on default.

Once you have created a PRG write file, you have to be able to write to it. The code below shows the normal flow of operations. Below that is the changes required to make be able to write:

– Before –

```
        ldx  logadd   ; get logical address
        jsr  chkin    ; set input device
        ;
; . . . get and print chars from file . . .
more    =    *
        jsr  chrin    ; get a char from disk
        jsr  chrout   ; print it to the screen
```

– After –

```
        ldx  logadd   ; get logical address
        jsr  chkout   ; set output device
        ;
; . . . get and print chars to file . . .
more    =    *
        jsr  getchr   ; ** your routine to supply the data
        jsr  chrout   ; output to disk
```

Pretty easy. Instead of setting the input device (CHKIN), you now set the output device (CHKOUT). The Kernal address for CHKOUT is $FFC9. Time for a quick interjection. If you want to simultaneously read from one file and write to another, there is one small problem. You would have to set the input device, read the character, set the output device, write the character, and continue this process until the input file has been read to your satisfaction. See below ;

```
        ldx  #readla  ; read logical address
        jsr  chkin    ; set input device
        jsr  chrin    ; get a character
        pha           ; retain the byte
        ldx  #wrtla   ; write logical address
        jsr  chkout   ; set output device
        pla           ; get it back
        jsr  chrout   ; output char
```

A little more tedious, but it works. Time to move on to file formats other than the PRG type.

Writing to a Sequential or User type file is a bit more difficult. A slight addition will have to be made to the filename, plus an alteration of the filename length will also have to be made to reflect this. The altered code could be something like this:

```
doit    =   *
        ldy  #0
        ;
; . . . add write suffix to filename . . .
alter   =   *
        lda  write,y    ; get data to add
        sta  inpbuf,x   ; place it following the filename
        inx
        iny
        cpy #length     ; end of extra data
        bne alter       ; not yet
        ;
        stx  lennam     ; set filename length
```

The ",s,w" at label WRITE should be placed near the data for the label PROMPT, just to keep it all in one place and out of the way. See below for label WRITE:

```
write   =   *
        .asc ",s,w"     ; change s to u for a user file
length  =   *-write
```

This covers writing to a Program, Sequential, and User file. As far as Relative files go, the modifications to my source would be a little more difficult. The Opening of a Relative file wouldn't be too horrific, but the positioning of records, writing for the first time, plus reading and writing thereafter could be code consuming. If you feel that life is not complete without this extra bit of knowledge, drop me a letter. With more than a couple requests, maybe.

As a final closing paragraph, I think a brief discussion regarding Opening files without a filename is in order. You may want to do this from time to time, as in the case of Opening the drives command channel for direct access work. The trick to this is simple. Don't bother with the filename pointers, and set the filename length to zero. If it was not a disk channel but a printer that required Opening, similar to the Basic incantation "OPEN 4,4", then assigning a value of 255 to the secondary address would perform the service. Two fast solutions for a few occasional problems. And so, with this article complete, I wish you luck in the land of disk access. With patience, and your thoughts collected, difficulties should not arise.

Basic 4.0 – Pet/CBM Version

```
MA  100 rem save " 0:disk 1.pal " ,8
HO  110 rem ** rte/85 – disk access in assembler – basic 4.0
            pet/cbm **
FI  120 open 4,8,1, " 0:disk 1.obj "
PB  130 sys(0)
DK  140 .opt o4
BN  150 *       = $027a
GB  160 ;
MA  170 status  = $96    ;file status
GE  180 lennam  = $d1    ;length of filename
JK  190 logadd  = $d2    ;logical address
CK  200 secadd  = $d3    ;secondary address
DE  210 devnum= $d4      ;device number
GL  220 name    = $da    ;filename (ptr)
IF  230 inpbuf  = $0200 ;input buffer
NK  240 input   = $b4e2 ;input routine
CG  250 prtstr  = $bb1d ;print string from y/a (hi/lo)
CH  260 close   = $f2e2  ;close file
FF  270 open    = $f563  ;open file
BL  280 chkin   = $ffc6  ;open channel for input          (kernal)
KO  290 clrchn  = $ffcc  ;restore default i/o             (kernal)
FI  300 chrin   = $ffcf  ;input char from channel         (kernal)
BF  310 chrout  = $ffd2  ;output char to channel          (kernal)
GL  320 ;
DM  330 ; ** disk read routine **
KM  340 ;
LM  350 ; . . . ask for filename . . .
GB  360         ldy   #>prompt
EM  370         lda   #<prompt
LI  380         jsr   prtstr      ;print string
CD  390         jsr   input       ;input filename into input buffer
HN  400         ldx   #0
AB  410 ;
HL  420 ; . . . determine length of filename . . .
NK  430 getlen  =     *
OA  440         lda   inpbuf,x    ;get char from inpbuf
FD  450         beq   doit        ;if = 0 then end of filename
IK  460         inx
MD  470         bne   getlen      ;un–conditional branch
GF  480 ;
LJ  490 ; . . . set–up filename . . .
JE  500 doit    =     *
LJ  510         stx   lennam      ;set filename length
NK  520         lda   #<inpbuf    ;set ptrs to name
DI  530         sta   name
HA  540         lda   #>inpbuf
DK  550         sta   name + 1
GK  560 ;
DD  570 ; . . . set–up file for open . . .
ND  580         lda   #7
EP  590         sta   logadd      ;set logical address
DF  600         lda   #8
OF  610         sta   devnum      ;set device number
```

```
JG  620          lda   #9
LO  630          sta   secadd     ;set secondary address
HM  640          ldx   #0
AA  650 ;
BA  660 ; . . . set length then open . . .
NC  670          jsr   open       ;open file
HN  680          ldx   logadd     ;get logical address
DD  690          jsr   chkin      ;set input device
CD  700 ;
FB  710 ; . . . get and print chars from file . . .
IJ  720 more     =     *
LC  730          jsr   chrin      ;get a char from disk
HL  740          jsr   chrout     ;print it to the screen
DB  750          lda   status     ;check if end-of-file
GK  760          beq   more       ;not yet - go for some more
IH  770 ;
BM  780          jsr   clrchn     ;clear channel
ED  790          lda   logadd     ;logical address
DL  800          jsr   close      ;close file
PC  810          rts              ;return to basic
KK  820 ;
NG  830 prompt   =     *
MJ  840          .asc  " filename ? "
MI  850          .byt  0
CN  860 ;
CE  870 .end
```

Commodore 64 Version

```
OA  100 rem save " 0:disk 2.pal " ,8
CN  110 rem ** rte/85 - disk access in assembler
            - c64 version **
JI  120 open 4,8,1, " 0:disk 2.obj "
NB  130 sys(700)
DK  140 .opt o4
PM  150 *        = $033c
GB  160 ;
MB  170 inpbuf   = $0200  ;input buffer
PI  180 input    = $a560  ;input routine          ($c560 for vic)
KJ  190 prtstr   = $ab1e  ;print string from y/a  ($cb1e for vic)
CH  200 readst   = $ffb7  ;read file status              (kernal)
FP  210 setlsf   = $ffba  ;set la, sa, and devnum        (kernal)
PG  220 setnam   = $ffbd  ;set-up filename               (kernal)
DI  230 open     = $ffc0  ;open file                     (kernal)
NJ  240 close    = $ffc3  ;close file                    (kernal)
DJ  250 chkin    = $ffc6  ;open channel for input        (kernal)
MM  260 clrchn   = $ffcc  ;restore default i/o           (kernal)
HG  270 chrin    = $ffcf  ;input char from channel       (kernal)
DD  280 chrout   = $ffd2  ;output char to channel        (kernal)
IJ  290 ;
FK  300 ; ** disk read routine **
MK  310 ;
NK  320 ; . . . ask for filename . . .
IP  330          ldy   #>prompt
GK  340          lda   #<prompt
NG  350          jsr   prtstr     ;print string
EB  360          jsr   input      ;input filename into input
                                   buffer
JL  370          ldx   #0
CP  380 ;
JJ  390 ; . . . determine length of filename . . .
PI  400 getlen   =     *
AP  410          lda   inpbuf,x   ;get char from inpbuf
HB  420          beq   doit       ;if = 0 then end of filename
KI  430          inx
OB  440          bne   getlen     ;un-conditional branch
ID  450 ;
NH  460 ; . . . set-up filename . . .
LC  470 doit     =     *
DC  480          txa              ;.a = length
EN  490          ldx   #<inpbuf   ;.x = name ptr lo
LM  500          ldy   #>inpbuf   ;.y = name ptr hi
LG  510          jsr   setnam     ;set-up filename
OH  520 ;
DK  530 ; . . . set-up file then open . . .
JD  540          lda   #7         ;logical address
MO  550          ldx   #8         ;device number
LN  560          ldy   #9         ;secondary address
LE  570          jsr   setlsf     ;set la, sa, and devnum
DN  580          jsr   open       ;open file
HM  590          ldx   #7         ;logical address
JN  600          jsr   chkin      ;set input device
IN  610 ;
LL  620 ; . . . get and print chars from file . . .
OD  630 more     =     *
BN  640          jsr   chrin      ;get a char from disk
NF  650          jsr   chrout     ;print it to the screen
NF  660          jsr   readst     ;check if end-of-file
ME  670          beq   more       ;not yet - go for some more
OB  680 ;
HG  690          jsr   clrchn     ;clear channel
JN  700          lda   #7         ;logical address
PH  710          jsr   close      ;close the file
ML  720          rts
AF  730 ;
DB  740 prompt   =     *
CE  750          .asc  " filename ? "
CD  760          .byt  0
IH  770 ;
IO  780 .end
```

Directory Match

Pierre Corriveau
Montreal, Quebec

As time passes by, your library of programs grows bigger and bigger. Utility programs, games, educational programs, and a lot of them have similar names.

Then one evening, you need to find that one utility program, you don't remember the whole name but you know there was the word "test" in it. Was it "Prt test pgm", "Test printer" or "Print. test" ? Which disk was it on ?

There you go, looking through all your disks, typing LOAD "$",8 and LIST dozens of times. Pattern matching can't help you since you don't know where the word "test" is located in the filename. You have to examine each filename; a long and boring job.

That's why DIR MATCH was created. Now all you have to do is load it in, insert the disk you want to search in the drive and type SYS 49152, "test". DIR MATCH will list any filename that contains "test" in it. You can also type SYS 49152 alone and it will list the whole directory on screen. To stop the listing, hold the SHIFT key. To abort it, press the BACK ARROW key.

Also, the program is made so that it can be relocated. The basic loader will take care of that. The PAL source code is included for those who are tuned to the fast paced world of machine language.

But wait a minute, what if you also forgot which disk DIR MATCH was on ?!?

DIR MATCH Basic Loader

```
CP  100 rem the routine uses channels #13 and #15
CN  110 ad=49152:rem change if you wish
JH  120 print"■directory search routine"
NC  130 print"■sys"ad"= directory listing"
MB  140 print"■sys"ad","chr$(34)"mon"chr$(34)
OJ  150 print"will list filenames containing"
PN  160 print"'mon' like 'micromon' and '64mon'
CA  170 print"■sys"ad",a$ also works"
AB  180 print"■pause listing with shift"
MO  190 print"halt with run/stop"
NI  200 print"■relocatable: look at line 110"
AE  210 print". . .please wait. . ."
AJ  220 gosub250
GO  230 end
EG  240 :
JO  250 a=ad:rem change if you wish
AM  260 read d:if d=-1 then 280
PL  270 poke a,d:ck=ck+d:a=a+1:goto 260
HO  280 if ck<>48226 then print"error in data lines 390-840":end
CA  290 a=ad
BK  300 for i=1 to 11
HF  310 read rt:ch=ch+rt
OA  320 read of:if of=-1 then 360
DM  330 ch=ch+of
CE  340 poke a+of+1,int((a+rt)/256):pokea+of,(a+rt)-256*int((a+rt)/256)
BA  350 goto320
MG  360 next
FL  370 if ch<>8490 then print"error in data lines 870-920":end
IJ  380 return
KH  390 data 169,   0, 141,  75, 193,  32, 121,   0
NA  400 data 240,  47,  32, 253, 174,  32, 158, 173
AE  410 data  32, 143, 173, 169,  13,  32, 210, 255
CF  420 data 160,   0, 177, 100, 201,  17, 144,   5
HP  430 data 162,  23,  76,  58, 164, 141,  75, 193
CI  440 data 200, 177, 100, 133,  20, 200, 177, 100
HO  450 data 133,  21, 165, 100, 164, 101,  32, 219
MO  460 data 182, 169,   0,  32, 189, 255, 169,  15
EN  470 data 162,   8, 160,  15,  32, 186, 255,  32
PC  480 data 192, 255, 144,   8,  72,  32, 232, 192
HC  490 data 104,  76,  59, 164, 169,   1, 162, 205
IH  500 data 160, 235,  32, 189, 255, 169,  13, 162
EE  510 data   8, 160,   0,  32, 186, 255,  32, 192
HF  520 data 255, 176, 225, 162,  15,  32, 198, 255
KC  530 data  32, 207, 255, 201,  48, 240,   3,  76
DM  540 data 220, 192,  32, 204, 255, 162,  13,  32
EI  550 data 198, 255,  32, 207, 255,  32, 207, 255
JF  560 data  32, 204, 255,  32, 246, 192,  32,  47
OJ  570 data 193,  32, 225, 255, 240,   8,  32, 246
PL  580 data 192,  16,   6,  32,  47, 193,  76, 232
KC  590 data 192, 173,  75, 193, 208,   7, 173, 141
DE  600 data   2, 208, 251, 240, 225, 162,   0, 189
DJ  610 data  80, 193, 232, 201,  34, 208, 248, 142
LN  620 data  77, 193, 160,   0, 189,  80, 193, 201
BK  630 data  34, 240, 206, 209,  20, 240,   8, 238
```

```
NN  640 data  77, 193, 174,  77, 193, 208, 235, 200
PD  650 data 232, 204,  75, 193, 208, 230,  32,  47
LO  660 data 193,  76, 145, 192,  32, 210, 255, 165
IA  670 data 144, 208,   5,  32, 207, 255, 208, 244
KF  680 data  32, 204, 255, 169,  13,  32, 195, 255
AF  690 data 169,  15,  32, 195, 255,  96, 169, 255
CH  700 data 141,  76, 193, 162,  13,  32, 198, 255
HE  710 data  32, 207, 255,  32, 207, 255, 240,  32
DI  720 data  32, 207, 255, 141,  78, 193,  32, 207
ME  730 data 255, 141,  79, 193, 160, 255, 200,  32
NI  740 data 207, 255, 153,  80, 193, 240,   9, 201
FD  750 data  34, 208, 243, 141,  76, 193, 240, 238
FL  760 data  32, 204, 255, 173,  76, 193,  96, 174
BO  770 data  78, 193, 173,  79, 193,  32, 205, 189
CB  780 data 160, 255, 169,  32,  32, 210, 255, 200
DB  790 data 185,  80, 193, 208, 247, 169,  13,  32
MK  800 data 210, 255,  96,   0, 255,   0,  32,  32
MC  810 data  32,  32,  32,  32,  32,  32,  32,  32
GD  820 data  32,  32,  32,  32,  32,  32,  32,  32
AE  830 data  32,  32,  32,  32,  32,  32,  32,  32
DE  840 data  32,  32,  32,  32,  -1
GM  850 :
HA  860 rem relocation code
HD  870 data 331,   3,  38, 162, 210,  -1, 220, 120
EG  880 data  -1, 246, 140, 151,  -1, 303, 143, 156
PA  890 data 215,  -1, 232, 159,  78,  -1, 336, 176
NI  900 data 189, 283, 321,  -1, 333, 184, 200, 203
KI  910 data  -1, 145, 218,  -1, 332, 249, 292, 300
MP  920 data  -1, 334, 268, 304,  -1, 335, 274, 307,  -1
```

DIR MATCH PAL Source Code

```
FD  100 sys700
LN  110 ;print the disk directory
OO  120 ;
KO  130 .opt oo
NH  140 *       =   $c000
FM  150 setfls  =   $ffba
CL  160 setnam  =   $ffbd
JO  170 open    =   $ffc0
MD  180 chkin   =   $ffc6
CK  190 chrin   =   $ffcf
EL  200 clrchn  =   $ffcc
PB  210 close   =   $ffc3
DA  220 chrout  =   $ffd2
BB  230 stop    =   $ffe1
AI  240 st      =   $90
CG  250 chrgot  =   $79
CJ  260 string  =   $14
EI  270 ;
CB  280 ;check if param is present
NA  290         lda  #0
PM  300         sta  strlen
EF  310         jsr  chrgot
AL  320         beq  opencmd
AM  330 ;
CA  340 ;get the string
PO  350         jsr  $aefd      ;check comma
BF  360         jsr  $ad9e      ;get parameter
HA  370         jsr  $ad8f      ;check if string
CA  380         lda  #13
NF  390         jsr  chrout
LN  400         ldy  #0
EH  410         lda  ($64),y    ;get string length
OF  420         cmp  #17        ;if > 16 error
NA  430         bcc  okstrlen
OP  440         ldx  #23        ;string too long error
MM  450         jmp  $a43a
ME  460 okstrlen =   *
FC  470         sta  strlen     ;save length
AM  480         iny
EB  490         lda  ($64),y    ;save pointer to string
LI  500         sta  string
ON  510         iny
ON  520         lda  ($64),y
LG  530         sta  string+1
AL  540         lda  $64
NB  550         ldy  $65
PP  560         jsr  $b6db      ;clean descriptor stack
AL  570 ;
OC  580 ;set command channel for open
HN  590 opencmd=    *
DE  600         lda  #0
DC  610         jsr  setnam
IP  620         lda  #15
NM  630         ldx  #8
MG  640         ldy  #15
CE  650         jsr  setfls
IA  660         jsr  open
MK  670         bcc  noerror
OB  680 ;
AM  690 knerror  =   *
KI  700         pha             ;save error number
JL  710         jsr  fini       ;close channel #15
IF  720         pla
MJ  730         jmp  $a43b      ;print kernal error msg
KF  740 ;
HE  750 ;set channel #13 for open
PA  760 noerror  =   *
PO  770         lda  #1
DA  780         ldx  #$cd       ;pt to '$' of keybrd mat.
AC  790         ldy  #$eb
BO  800         jsr  setnam
AK  810 ;
EE  820 ;set file name to "$"
EM  830         lda  #13
PJ  840         ldx  #8
NJ  850         ldy  #0
EB  860         jsr  setfls
KN  870         jsr  open
JL  880         bcs  knerror
AP  890 ;
KP  900 ;check if everything ok
GH  910         ldx  #15
DJ  920         jsr  chkin
CL  930         jsr  chrin
BD  940         cmp  #"0"       ;'0' means ok
GM  950         beq  br1
KH  960         jmp  perror     ;print error and exit
AE  970 ;
EB  980 ;looking good. disconnect ch #15
ME  990 ;and start printing
OF 1000 ;
KD 1010 br1      =   *
DA 1020         jsr  clrchn
IO 1030         ldx  #13
LA 1040         jsr  chkin
ME 1050         jsr  chrin      ;skip load adrs
LK 1060         jsr  chrin      ;with 2 chrins
FD 1070         jsr  clrchn
```

```
OK 1080 ;
FE 1090 ;print disk name
OJ 1100          jsr   getfile
LA 1110 dir      =     *
NO 1120          jsr   prtfile
AA 1130 nextfile =     *
HJ 1140          jsr   stop       ;stop key pressed "?
OE 1150          beq   done       ;if so exit
KN 1160          jsr   getfile
NC 1170          bpl   notdone
CN 1180          jsr   prtfile    ;prt nb of blks
PP 1190 done     =     *
EJ 1200          jmp   fini       ;close all files and exit
HM 1210 notdone  =     *
GO 1220          lda   strlen     ;null string "?
PG 1230          bne   match
JM 1240 waitshft =     *
DF 1250          lda   $028d      ;shift key flag
KO 1260          bne   waitshft
JF 1270          beq   dir
GH 1280 ;
KN 1290 ;check for a match
KF 1300 match    =     *
GK 1310          ldx   #0         ,search for first quote
CL 1320 match2   =     *
PN 1330          lda   flname+2,x
IB 1340          inx
IB 1350          cmp   #34
FF 1360          bne   match2
CI 1370          stx   flindex    ;store in index
LO 1380 match1   =     *
LD 1390          ldy   #0         ;pt to 1st char of string
OO 1400 ;
KB 1410 nextchar =     *
JD 1420          lda   flname+2,x
EF 1430          cmp   #34        ;quote = end of filename
FJ 1440          beq   nextfile
KK 1450          cmp   (string),y ;does char match "?
EP 1460          beq   charmat
CH 1470          inc   flindex    ;no, check next char
DF 1480          ldx   flindex
NI 1490          bne   match1     ;jump
HE 1500 charmat  =     *
MO 1510          iny              ;partial match, bump index
MM 1520          inx
FE 1530          cpy   strlen     ;if not whole string
FE 1540          bne   nextchar   ;done, check next chr
EI 1550 ;
DG 1560 ;got a match !
PK 1570          jsr   prtfile
FE 1580          jmp   nextfile
MK 1590 ;
PP 1600 ;there was an error; print it
AI 1610 ;the first char of the error msg
NP 1620 ;is already in the accumulator
EN 1630 ;
HJ 1640 perror   =     *
JE 1650          jsr   chrout
PN 1660          lda   st
EA 1670          bne   fini       ;done. back to basic
AK 1680          jsr   chrin
JH 1690          bne   perror     ;jump
KB 1700 ;
LN 1710 ;all done. go back to basic
IA 1720 fini     =     *
JM 1730          jsr   clrchn
CF 1740          lda   #13
LE 1750          jsr   close
MG 1760          lda   #15
PF 1770          jsr   close
AO 1780          rts
EH 1790 ;
NM 1800 ;input filename in buffer
ON 1810 ;on return flag = 255 means end
DP 1820 ;              flag =  34 means ok
MJ 1830 ;
EA 1840 getfile  =     *
MJ 1850          lda   #255
HK 1860          sta   flag
AD 1870          ldx   #13
DF 1880          jsr   chkin
PG 1890          jsr   chrin      ;skip forward chain
ME 1900          jsr   chrin      ;except zero chain
EH 1910          beq   get2       ;means end
GP 1920 ;
EI 1930 cont     =     *
BC 1940          jsr   chrin      ;get nb of blocks
HO 1950          sta   flname
IL 1960          jsr   chrin
NL 1970          sta   flname+1
CD 1980 ;
FB 1990 ;let's get text
CJ 2000          ldy   #255
NG 2010 text     =     *
EM 2020          iny
OP 2030          jsr   chrin
FO 2040          sta   flname+2,y
CK 2050          beq   get2       ;0= end of line
IE 2060          cmp   #34        ;quote "?
NK 2070          bne   text       ;no, get some more
KO 2080          sta   flag       ;yes, set the flag
JE 2090          beq   text       ;jump
AI 2100 get2     =     *
FE 2110          jsr   clrchn
NG 2120          lda   flag
OD 2130          rts
CN 2140 ;
JJ 2150 ;routine to print filename
IC 2160 ;filename ends with a zero byte
KD 2170 prtfile  =     *
LJ 2180          ldx   flname     ;print nb of blocks
LF 2190          lda   flname+1
BD 2200          jsr   $bdcd
EG 2210          ldy   #255
FG 2220          lda   #" "       ;1 space
FD 2230 prt1     =     *
HJ 2240          jsr   chrout
KK 2250          iny
DI 2260          lda   flname+2,y
EB 2270          bne   prt1
OG 2280          lda   #13
JM 2290          jsr   chrout
IO 2300          rts
MH 2310 ;
BL 2320 strlen   .byte 0
IN 2330 flag     .byte 255
PG 2340 flindex  .byte 0
CE 2350 flname   .asc "                              " ;30 spaces
```

Commodore 64 Memory Configurations

William Levak
Ann Arbor, MI

Effects Of The PLA Chip In All Situations

The major obstacle to understanding the Commodore 64's memory is the 82S100 programmed logic array (PLA) that controls it. What we need is the truth table for the chip. A truth table is a table that shows the output on every output pin for every possible combination of inputs on the input pins. We would normally find the truth table for a chip on the manufacturer's data sheet. However, a programmed logic array does not have a truth table until it is programmed (in this case by Commodore), and Commodore has not published the truth table. I have therefore read out the chip and obtained the truth table which is shown in the first table.

How To Read The Truth Table

At the left side of the table are the names of the inputs (pins I0-I15) and outputs (pins F0–F7) of the PLA as given in the circuit diagram in the Commodore 64 Programmer's Reference Guide. The 26 columns in the table each represent a combination of inputs recognized by the PLA and the outputs that combination causes. The first column with all the inputs marked with a '–' represents the default output state, that is, if none of the other input conditions are met, then the output will be as indicated in this column. For all the other columns, a '1' indicates a high input state (+5 V), a '0' indicates a low input state (0 V), and an 'x' represents an input that is ignored for this column. If the input conditions in a particular column are met then the outputs will be changed from the default condition.

A "1" indicates that the output will change from low to high,
a "0" indicates that the output will change from high to low, and
an "x" indicates that the output will remain in the default state.

It is possible that more than one input condition will be met at the same time, and their outputs will then be combined. This occurs only with certain timing signals necessary to access RAM.

Although the truth table is the most complete description of the PLA possible, it is not very useful to the average programmer. I have therefore produced memory maps of the fourteen possible memory configurations of the Commodore 64. The memory configuration is selected by five lines on the PLA:

LORAM, HIRAM, and CHAREN are controlled by bits 0, 1, and 2 at memory location 1.

GAME and EXROM are two lines on the cartridge expansion port and are controlled by the circuitry on the cartridge.

All five lines are normally high.

The addresses at the left of the table are the beginning to ending addresses of each 4K block. KERNL, BASIC, and CHARA refer to the kernal, BASIC and character ROMs respectively. I/O refers to the 4K I/O block which contains all the I/O chips and the color memory. ROM H and ROM L refer to two cartridge ROMs which can be up to 8K in length. The 4K ROM H blocks in the VIC column in the last configuration (the game configuration) are the top 4K of the 8K ROM H block seen by the CPU. Ram, of course, refers to random access memory.

Each memory map contains four columns. This is because the memory configuration differs according to the device accessing it and whether it is reading or writing. The column on the right is what the VIC chip sees when reading. The column on the left is what the CPU sees when writing. Both columns in the center are what the CPU sees when reading, but under different conditions. The VIC chip and the CPU share the same address and data busses, but on opposite phases of the clock cycle. Occasionally the VIC chip needs the busses longer than half a clock cycle. When this occurs, the VIC chip pulls line BA low. When the CPU sees that BA is low it runs for three clock cycles and then halts. During these three cycles the memory configuration is as described in the column marked R(-BA). At all other times it is as described in the column headed R(BA). Notice that this affects only the CPU reading the I/O block. During these three cycles the I/O block is unavailable and RAM is seen instead. Writing to the I/O block is still possible however.

Some final notes: In compiling this information I have read out three PLAs and each had different numbers on them. In order to eliminate transcription errors, all the tables were generated directly by computer programs from a disk file containing the information from the PLA. The careful reader will spot differences between the information presented here and that contained in the Commodore 64 Programmer's Reference Guide. All such differences were verified manually against the original data file created by reading out the PLA, which itself was verified against two other PLAs as noted above.

Inputs		Commodore 64 PLA																									
I0	$\overline{CAS}$	×	×	×	×	×	×	×	×	×	×	×	0	×	×	×	×	×	×	×	×	–	1	0	0	0	0
I1	$\overline{LORAM}$	×	×	×	×	1	×	×	1	×	×	1	×	×	×	×	1	×	×	×	1	–	×	×	×	×	×
I2	$\overline{HIRAM}$	×	×	1	×	1	1	×	0	1	×	0	×	×	×	1	0	1	1	1	1	–	×	×	×	×	×
I3	$\overline{CHAREN}$	×	×	×	×	×	1	×	1	1	×	1	×	×	×	0	0	0	×	×	×	–	×	×	×	×	×
I4	$\overline{VA14}$	×	×	×	×	×	×	×	×	×	×	×	×	1	1	×	×	×	×	×	×	–	×	×	×	×	×
I5	A15	×	1	1	1	1	1	1	1	1	1	1	1	×	×	1	1	1	1	1	1	–	×	0	×	0	1
I6	A14	×	1	0	0	0	1	1	1	1	1	1	1	×	×	1	1	1	1	1	0	–	×	1	0	0	1
I7	A13	×	1	1	0	0	0	0	0	0	0	0	0	×	×	0	0	0	1	1	1	–	×	×	1	0	0
I8	A12	×	×	×	×	×	1	1	1	1	1	1	1	×	×	1	1	1	×	×	×	–	×	×	×	1	0
I9	BA	×	×	×	×	×	×	×	×	1	1	1	×	×	×	×	×	×	×	×	×	–	×	×	×	×	×
I10	$\overline{AEC}$	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	–	×	×	×	×	×
I11	R/$\overline{W}$	×	×	1	×	1	0	0	0	1	1	1	0	×	×	1	1	1	1	1	1	–	×	×	×	×	×
I12	$\overline{EXROM}$	1	1	0	1	0	×	1	×	×	1	×	×	0	1	×	×	0	×	0	×	–	×	1	1	1	1
I13	$\overline{GAME}$	0	0	0	0	×	×	0	×	×	0	×	×	×	1	1	1	0	1	0	1	–	×	0	0	0	0
I14	VA13	1	×	×	×	×	×	×	×	×	×	×	×	0	0	×	×	×	×	×	×	–	×	×	×	×	×
I15	VA12	1	×	×	×	×	×	×	×	×	×	×	×	1	1	×	×	×	×	×	×	–	×	×	×	×	×
Outputs																											
F0	$\overline{CASRAM}$	1	1	1	1	1	1	1	1	1	1	1	×	1	1	1	1	1	1	1	1	**0**	1	1	1	1	1
F1	$\overline{BASIC}$	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	0	**1**	×	×	×	×	×
F2	$\overline{KERNAL}$	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	0	0	×	1	**1**	×	×	×	×	×
F3	$\overline{CHAROM}$	×	×	×	×	×	×	×	×	×	×	×	×	0	0	0	0	0	×	×	×	**1**	×	×	×	×	×
F4	GR/$\overline{W}$	×	×	×	×	×	×	×	×	×	×	×	0	×	×	×	×	×	×	×	×	**1**	×	×	×	×	×
F5	$\overline{I}$/O	×	×	×	×	×	0	0	0	0	0	0	×	×	×	×	×	×	×	×	×	**1**	×	×	×	×	×
F6	$\overline{ROM\ L}$	×	×	×	0	0	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	**1**	×	×	×	×	×
F7	$\overline{ROM\ H}$	0	0	0	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	**1**	×	×	×	×	×

GAME 1
EXROM 1
CHAREN 1
HIRAM 1
LORAM 1

	CPU			VIC
	W	R($\overline{BA}$)	R(BA)	R
$F000 – FFFF	ram	KERNL	KERNL	ram
$E000 – EFFF	ram	KERNL	KERNL	ram
$D000 – DFFF	I/O	ram	I/O	ram
$C000 – CFFF	ram	ram	ram	ram
$B000 – BFFF	ram	BASIC	BASIC	ram
$A000 – AFFF	ram	BASIC	BASIC	ram
$9000 – 9FFF	ram	ram	ram	CHARA
$8000 – 8FFF	ram	ram	ram	ram
$7000 – 7FFF	ram	ram	ram	ram
$6000 – 6FFF	ram	ram	ram	ram
$5000 – 5FFF	ram	ram	ram	ram
$4000 – 4FFF	ram	ram	ram	ram
$3000 – 3FFF	ram	ram	ram	ram
$2000 – 2FFF	ram	ram	ram	ram
$1000 – 1FFF	ram	ram	ram	CHARA
$0000 – 0FFF	ram	ram	ram	ram

GAME 1
EXROM 1
CHAREN 0
HIRAM 1
LORAM 1

	CPU			VIC
	W	R($\overline{BA}$)	R(BA)	R
$F000 – FFFF	ram	KERNL	KERNL	ram
$E000 – EFFF	ram	KERNL	KERNL	ram
$D000 – DFFF	ram	CHARA	CHARA	ram
$C000 – CFFF	ram	ram	ram	ram
$B000 – BFFF	ram	BASIC	BASIC	ram
$A000 – AFFF	ram	BASIC	BASIC	ram
$9000 – 9FFF	ram	ram	ram	CHARA
$8000 – 8FFF	ram	ram	ram	ram
$7000 – 7FFF	ram	ram	ram	ram
$6000 – 6FFF	ram	ram	ram	ram
$5000 – 5FFF	ram	ram	ram	ram
$4000 – 4FFF	ram	ram	ram	ram
$3000 – 3FFF	ram	ram	ram	ram
$2000 – 2FFF	ram	ram	ram	ram
$1000 – 1FFF	ram	ram	ram	CHARA
$0000 – 0FFF	ram	ram	ram	ram

GAME 1 EXROM 0 CHAREN 1 HIRAM 1 LORAM 1				
	CPU			VIC
	W	R($\overline{BA}$)	R(BA)	R
$F000 – FFFF	ram	KERNL	KERNL	ram
$E000 – EFFF	ram	KERNL	KERNL	ram
$D000 – DFFF	I/O	ram	I/O	ram
$C000 – CFFF	ram	ram	ram	ram
$B000 – BFFF	ram	BASIC	BASIC	ram
$A000 – AFFF	ram	BASIC	BASIC	ram
$9000 – 9FFF	ram	ROM L	ROM L	CHARA
$8000 – 8FFF	ram	ROM L	ROM L	ram
$7000 – 7FFF	ram	ram	ram	ram
$6000 – 6FFF	ram	ram	ram	ram
$5000 – 5FFF	ram	ram	ram	ram
$4000 – 4FFF	ram	ram	ram	ram
$3000 – 3FFF	ram	ram	ram	ram
$2000 – 2FFF	ram	ram	ram	ram
$1000 – 1FFF	ram	ram	ram	CHARA
$0000 – 0FFF	ram	ram	ram	ram

GAME 1 EXROM 0 CHAREN 0 HIRAM 1 LORAM 1				
	CPU			VIC
	W	R($\overline{BA}$)	R(BA)	R
$F000 – FFFF	ram	KERNL	KERNL	ram
$E000 – EFFF	ram	KERNL	KERNL	ram
$D000 – DFFF	ram	CHARA	CHARA	ram
$C000 – CFFF	ram	ram	ram	ram
$B000 – BFFF	ram	BASIC	BASIC	ram
$A000 – AFFF	ram	BASIC	BASIC	ram
$9000 – 9FFF	ram	ROM L	ROM L	CHARA
$8000 – 8FFF	ram	ROM L	ROM L	ram
$7000 – 7FFF	ram	ram	ram	ram
$6000 – 6FFF	ram	ram	ram	ram
$5000 – 5FFF	ram	ram	ram	ram
$4000 – 4FFF	ram	ram	ram	ram
$3000 – 3FFF	ram	ram	ram	ram
$2000 – 2FFF	ram	ram	ram	ram
$1000 – 1FFF	ram	ram	ram	CHARA
$0000 – 0FFF	ram	ram	ram	ram

GAME 0 EXROM 0 CHAREN 1 HIRAM 1 LORAM 1				
	CPU			VIC
	W	R($\overline{BA}$)	R(BA)	R
$F000 – FFFF	ram	KERNL	KERNL	ram
$E000 – EFFF	ram	KERNL	KERNL	ram
$D000 – DFFF	I/O	ram	I/O	ram
$C000 – CFFF	ram	ram	ram	ram
$B000 – BFFF	ram	ROM H	ROM H	ram
$A000 – AFFF	ram	ROM H	ROM H	ram
$9000 – 9FFF	ram	ROM L	ROM L	CHARA
$8000 – 8FFF	ram	ROM L	ROM L	ram
$7000 – 7FFF	ram	ram	ram	ram
$6000 – 6FFF	ram	ram	ram	ram
$5000 – 5FFF	ram	ram	ram	ram
$4000 – 4FFF	ram	ram	ram	ram
$3000 – 3FFF	ram	ram	ram	ram
$2000 – 2FFF	ram	ram	ram	ram
$1000 – 1FFF	ram	ram	ram	CHARA
$0000 – 0FFF	ram	ram	ram	ram

GAME 0 EXROM 0 CHAREN 0 HIRAM 1 LORAM 1				
	CPU			VIC
	W	R($\overline{BA}$)	R(BA)	R
$F000 – FFFF	ram	KERNL	KERNL	ram
$E000 – EFFF	ram	KERNL	KERNL	ram
$D000 – DFFF	ram	CHARA	CHARA	ram
$C000 – CFFF	ram	ram	ram	ram
$B000 – BFFF	ram	ROM H	ROM H	ram
$A000 – AFFF	ram	ROM H	ROM H	ram
$9000 – 9FFF	ram	ROM L	ROM L	CHARA
$8000 – 8FFF	ram	ROM L	ROM L	ram
$7000 – 7FFF	ram	ram	ram	ram
$6000 – 6FFF	ram	ram	ram	ram
$5000 – 5FFF	ram	ram	ram	ram
$4000 – 4FFF	ram	ram	ram	ram
$3000 – 3FFF	ram	ram	ram	ram
$2000 – 2FFF	ram	ram	ram	ram
$1000 – 1FFF	ram	ram	ram	CHARA
$0000 – 0FFF	ram	ram	ram	ram

GAME 0
EXROM 0
CHAREN 1
HIRAM 1
LORAM 0

	CPU			VIC
	W	R($\overline{BA}$)	R(BA)	R
$F000 – FFFF	ram	KERNL	KERNL	ram
$E000 – EFFF	ram	KERNL	KERNL	ram
$D000 – DFFF	I/O	ram	I/O	ram
$C000 – CFFF	ram	ram	ram	ram
$B000 – BFFF	ram	ROM H	ROM H	ram
$A000 – AFFF	ram	ROM H	ROM H	ram
$9000 – 9FFF	ram	ram	ram	CHARA
$8000 – 8FFF	ram	ram	ram	ram
$7000 – 7FFF	ram	ram	ram	ram
$6000 – 6FFF	ram	ram	ram	ram
$5000 – 5FFF	ram	ram	ram	ram
$4000 – 4FFF	ram	ram	ram	ram
$3000 – 3FFF	ram	ram	ram	ram
$2000 – 2FFF	ram	ram	ram	ram
$1000 – 1FFF	ram	ram	ram	CHARA
$0000 – 0FFF	ram	ram	ram	ram

GAME 0
EXROM 0
CHAREN 0
HIRAM 1
LORAM 0

	CPU			VIC
	W	R($\overline{BA}$)	R(BA)	R
$F000 – FFFF	ram	KERNL	KERNL	ram
$E000 – EFFF	ram	KERNL	KERNL	ram
$D000 – DFFF	ram	CHARA	CHARA	ram
$C000 – CFFF	ram	ram	ram	ram
$B000 – BFFF	ram	ROM H	ROM H	ram
$A000 – AFFF	ram	ROM H	ROM H	ram
$9000 – 9FFF	ram	ram	ram	CHARA
$8000 – 8FFF	ram	ram	ram	ram
$7000 – 7FFF	ram	ram	ram	ram
$6000 – 6FFF	ram	ram	ram	ram
$5000 – 5FFF	ram	ram	ram	ram
$4000 – 4FFF	ram	ram	ram	ram
$3000 – 3FFF	ram	ram	ram	ram
$2000 – 2FFF	ram	ram	ram	ram
$1000 – 1FFF	ram	ram	ram	CHARA
$0000 – 0FFF	ram	ram	ram	ram

GAME 1
EXROM x
CHAREN 1
HIRAM 1
LORAM 0

	CPU			VIC
	W	R($\overline{BA}$)	R(BA)	R
$F000 – FFFF	ram	KERNL	KERNL	ram
$E000 – EFFF	ram	KERNL	KERNL	ram
$D000 – DFFF	I/O	ram	I/O	ram
$C000 – CFFF	ram	ram	ram	ram
$B000 – BFFF	ram	ram	ram	ram
$A000 – AFFF	ram	ram	ram	ram
$9000 – 9FFF	ram	ram	ram	CHARA
$8000 – 8FFF	ram	ram	ram	ram
$7000 – 7FFF	ram	ram	ram	ram
$6000 – 6FFF	ram	ram	ram	ram
$5000 – 5FFF	ram	ram	ram	ram
$4000 – 4FFF	ram	ram	ram	ram
$3000 – 3FFF	ram	ram	ram	ram
$2000 – 2FFF	ram	ram	ram	ram
$1000 – 1FFF	ram	ram	ram	CHARA
$0000 – 0FFF	ram	ram	ram	ram

GAME 1
EXROM x
CHAREN 0
HIRAM 1
LORAM 0

	CPU			VIC
	W	R($\overline{BA}$)	R(BA)	R
$F000 – FFFF	ram	KERNL	KERNL	ram
$E000 – EFFF	ram	KERNL	KERNL	ram
$D000 – DFFF	ram	CHARA	CHARA	ram
$C000 – CFFF	ram	ram	ram	ram
$B000 – BFFF	ram	ram	ram	ram
$A000 – AFFF	ram	ram	ram	ram
$9000 – 9FFF	ram	ram	ram	CHARA
$8000 – 8FFF	ram	ram	ram	ram
$7000 – 7FFF	ram	ram	ram	ram
$6000 – 6FFF	ram	ram	ram	ram
$5000 – 5FFF	ram	ram	ram	ram
$4000 – 4FFF	ram	ram	ram	ram
$3000 – 3FFF	ram	ram	ram	ram
$2000 – 2FFF	ram	ram	ram	ram
$1000 – 1FFF	ram	ram	ram	CHARA
$0000 – 0FFF	ram	ram	ram	ram

GAME	1	0
EXROM	×	0
CHAREN	1	1
HIRAM	0	0
LORAM	1	1

	CPU			VIC
	W	R($\overline{BA}$)	R(BA)	R
$F000 – FFFF	ram	ram	ram	ram
$E000 – EFFF	ram	ram	ram	ram
$D000 – DFFF	I/O	ram	I/O	ram
$C000 – CFFF	ram	ram	ram	ram
$B000 – BFFF	ram	ram	ram	ram
$A000 – AFFF	ram	ram	ram	ram
$9000 – 9FFF	ram	ram	ram	CHARA
$8000 – 8FFF	ram	ram	ram	ram
$7000 – 7FFF	ram	ram	ram	ram
$6000 – 6FFF	ram	ram	ram	ram
$5000 – 5FFF	ram	ram	ram	ram
$4000 – 4FFF	ram	ram	ram	ram
$3000 – 3FFF	ram	ram	ram	ram
$2000 – 2FFF	ram	ram	ram	ram
$1000 – 1FFF	ram	ram	ram	CHARA
$0000 – 0FFF	ram	ram	ram	ram

GAME	1
EXROM	x
CHAREN	0
HIRAM	0
LORAM	1

	CPU			VIC
	W	R($\overline{BA}$)	R(BA)	R
$F000 – FFFF	ram	ram	ram	ram
$E000 – EFFF	ram	ram	ram	ram
$D000 – DFFF	ram	CHARA	CHARA	ram
$C000 – CFFF	ram	ram	ram	ram
$B000 – BFFF	ram	ram	ram	ram
$A000 – AFFF	ram	ram	ram	ram
$9000 – 9FFF	ram	ram	ram	CHARA
$8000 – 8FFF	ram	ram	ram	ram
$7000 – 7FFF	ram	ram	ram	ram
$6000 – 6FFF	ram	ram	ram	ram
$5000 – 5FFF	ram	ram	ram	ram
$4000 – 4FFF	ram	ram	ram	ram
$3000 – 3FFF	ram	ram	ram	ram
$2000 – 2FFF	ram	ram	ram	ram
$1000 – 1FFF	ram	ram	ram	CHARA
$0000 – 0FFF	ram	ram	ram	ram

GAME	1	0	0
EXROM	×	0	0
CHAREN	×	×	0
HIRAM	0	0	0
LORAM	0	0	1

	CPU			VIC
	W	R($\overline{BA}$)	R(BA)	R
$F000 – FFFF	ram	ram	ram	ram
$E000 – EFFF	ram	ram	ram	ram
$D000 – DFFF	ram	ram	ram	ram
$C000 – CFFF	ram	ram	ram	ram
$B000 – BFFF	ram	ram	ram	ram
$A000 – AFFF	ram	ram	ram	ram
$9000 – 9FFF	ram	ram	ram	CHARA
$8000 – 8FFF	ram	ram	ram	ram
$7000 – 7FFF	ram	ram	ram	ram
$6000 – 6FFF	ram	ram	ram	ram
$5000 – 5FFF	ram	ram	ram	ram
$4000 – 4FFF	ram	ram	ram	ram
$3000 – 3FFF	ram	ram	ram	ram
$2000 – 2FFF	ram	ram	ram	ram
$1000 – 1FFF	ram	ram	ram	CHARA
$0000 – 0FFF	ram	ram	ram	ram

GAME	0
EXROM	1
CHAREN	x
HIRAM	x
LORAM	x

	CPU			VIC
	W	R($\overline{BA}$)	R(BA)	R
$F000 – FFFF	ROM H	ROM H	ROM H	ROM H
$E000 – EFFF	ROM H	ROM H	ROM H	ram
$D000 – DFFF	I/O	ram	I/O	ram
$C000 – CFFF				ram
$B000 – BFFF				ROM H
$A000 – AFFF				ram
$9000 – 9FFF	ROM L	ROM L	ROM L	ram
$8000 – 8FFF	ROM L	ROM L	ROM L	ram
$7000 – 7FFF				ROM H
$6000 – 6FFF				ram
$5000 – 5FFF				ram
$4000 – 4FFF				ram
$3000 – 3FFF				ROM H
$2000 – 2FFF				ram
$1000 – 1FFF				ram
$0000 – 0FFF	ram	ram	ram	ram

Undocumented 6510 Op-Codes (see V6 I05 Page 58) – Raymond Quirling, Kerby, OR

Jim	Op	Mne	Mode	1st	2nd	Comment
SAX	cb*	acm	#$nn	(and)	(cmp)	xr=(ar&xr)–#$nn:cmp flags
ASO	0b*	ann	#$nn	and		Same as 29: and #$nn But c=1 if bit 7=1
RLA	2b*	ann	#$nn	and		duplicate of 0b
ARR	6b*	arr	#$nn	and	(ror)	And: Rotate carry Right bit 7=shift out of c:c=shift out of bit 7 v=shift out of bit 7 or bit 6 z=1 if result=0
ALR	4b	asr	#$nn	and	lsr	And, Shift Right into carry
AXS	83	axs	($zp,x)	(and)	store	M=ar&xr:ar,xr,flags unchanged
	87	axs	$zp	(and)	store	
	8f	axs	$addr	(and)	store	
	93*	axs	($zp),y	(and)	store	M=ar&xr&$zz
	97	axs	$zp,y	(and)	store	
MKA	9f*	axs	$addr,y	(and)	store	M=ar&xr&$zz
DCM	c3	dcm	($zp,x)	dec	cmp	cmp flags
	c7	dcm	$zp	dec	cmp	
	cf	dcm	$addr	dec	cmp	
	d3	dcm	($zp),y	dec	cmp	
	d7	dcm	$zp,y	dec	cmp	
	db	dcm	$addr,y	dec	cmp	
	df	dcm	$addr,x	dec	cmp	
INS	e3	isb	($zp,x)	inc	sbc	
	e7	isb	$zp	inc	sbc	
	ef	isb	$addr	inc	sbc	
	f3	isb	($zp),y	inc	sbc	
	f7	isb	$zp,x	inc	sbc	
	fb	isb	$addr,y	inc	sbc	
	ff	isb	$addr,x	inc	sbc	
	bb	**lsa**	$addr,y	(txs)	store	sp=xr=ar=M&$F6:AND flags
XAA	9b*	lss	$addr,y	(txs)	store	sp=ar&xr: M=ar&xr&$zz
LAX	a3	ltx	($zp,x)	lda	tax	xr=ar=M
	a7	ltx	$zp	lda	tax	
	af	ltx	$addr	lda	tax	
	b3	ltx	($zp),y	lda	tax	
	b7	ltx	$zp,y	lda	tax	
	bf	ltx	$addr,y	lda	tax	
XAA	8b*	oxa	#$nn	(ora)	(and)	ar=ar!$EE&xr&#$nn
OAL	ab	oxx	#$nn	(ora)	(and)	(tax) xr=ar=ar!$EE&xr&#$nn
RLA	23	rln	($zp,x)	rol	and	Rotate Left thru carry: aNd
	27	rln	$zp	rol	and	
	2f	rln	$addr	rol	and	
	33	rln	($zp),y	rol	and	
	37	rln	$zp,x	rol	and	
	3b	rln	$addr,y	rol	and	
	3f	rln	$addr,x	rol	and	
RRA	63	rrd	($zp,x)	ror	adc	Rotate Right thru carry: aDc
	67	rrd	$zp	ror	adc	
	6f	rrd	$addr	ror	adc	
	73	rrd	($zp),y	ror	adc	
	77	rrd	$zp,x	ror	adc	
	7b	rrd	$addr,y	ror	adc	
	7f	rrd	$addr,x	ror	adc	
	eb	**sbc**	#$nn	sbc		duplicate of standard e9 sbc #$nn

Jim	Op	Mne	Mode	1st	2nd	Comment
ASO	03	slo	($zp,x)	asl	ora	Shift Left into carry: Ora
	07	slo	$zp	asl	ora	
	0f	slo	$addr	asl	ora	
	13	slo	($zp),y	asl	ora	
	17	slo	$zp,x	asl	ora	
	1b	slo	$addr,y	asl	ora	
	1f	slo	$addr,x	asl	ora	
LSE	43	sre	($zp,x)	lsr	eor	Shift Right into carry: Eor
	47	sre	$zp	lsr	eor	
	4f	sre	$addr	lsr	eor	
	53	sre	($zp),y	lsr	eor	
	57	sre	$zp,x	lsr	eor	
	5b	sre	$addr,y	lsr	eor	
	5f	sre	$addr,x	lsr	eor	
MKX	9e*	xas	$addr,y	(and)	store	M=xr&$zz
	9c	**yas**	$addr,x	(and)	store	M=yr&$zz
CIM	02	dth	!!!			death–lockup
	12	dth	!!!			death–lockup
	22	dth	!!!			death–lockup
	32	dth	!!!			death–lockup
	42	dth	!!!			death–lockup
	52	dth	!!!			death–lockup
	62	dth	!!!			death–lockup
	72	dth	!!!			death–lockup
	92	dth	!!!			death–lockup
	b2	dth	!!!			death–lockup
	d2	dth	!!!			death–lockup
	f2	dth	!!!			death–lockup
NOP	1a	nop				pc+1
	3a	nop				pc+1
	5a	nop				pc+1
	7a	nop				pc+1
	da	nop				pc+1
	fa	nop				pc+1
SKB	04	skb	#$nn			pc+2
	14	skb	#$nn			pc+2
	34	skb	#$nn			pc+2
	44	skb	#$nn			pc+2
	54	skb	#$nn			pc+2
	64	skb	#$nn			pc+2
	74	skb	#$nn			pc+2
	80	skb	#$nn			pc+2
	82	skb	#$nn			pc+2
	89*	skb	#$nn			pc+2
	c2	skb	#$nn			pc+2
	d4	skb	#$nn			pc+2
	e2	skb	#$nn			pc+2
	f4	skb	#$nn			pc+2
SKW	0c	skw	$addr			pc+3
	1c	skw	$addr			pc+3
	3c	skw	$addr			pc+3
	5c	skw	$addr			pc+3
	7c	skw	$addr			pc+3
	dc	skw	$addr			pc+3
	fc	skw	$addr			pc+3

Undocumented 6500 Series Instructions (see V6 I05 Page 59) – Noel Nyman, Seattle, WA

Name/Operation	Mode	M.L. Form	Op	Bytes
AAX	Zero Page	AAX $aa	87	2
A&X to M	Zero Page,Y	AAX $aa,Y	97	2
AND A with X	Pre–Indexed,X	AAX ($aa,X)	83	2
	Post–Indexed,Y	AAX ($aa),Y	93	2
	Absolute	AAX $aaaa	8F	2
DCP	Zero Page	DCP $aa	C7	2
A–(DECM)	Zero Page,X	DCP $aa,X	D7	2
Decrement M,	Pre–Indexed,X	DCP ($aa,X)	C3	2
Compare with A	Post–Indexed,Y	DCP ($aa),Y	D3	2
	Absolute	DCP $aaaa	CF	3
	Absolute,X	DCP $aaaa,X	DF	3
	Absolute,Y	DCP $aaaa,Y	DB	3
ISB	Zero Page	ISB $aa	E7	2
A–(INCM)–C to A,C	Zero Page,X	ISB $aa,X	F7	2
Increment M,	Pre–Indexed,X	ISB ($aa,X)	E3	2
Subtract from A	Post–Indexed,Y	ISB ($aa),Y	F3	2
	Absolute	ISB $aaaa	EF	3
	Absolute,X	ISB $aaaa,X	FF	3
	Absolute,Y	ISB $aaaa,Y	FB	3
LAX	Zero Page	LAX $aa	A7	2
M to A,M to X	Zero Page,Y	LAX $aa,Y	B7	2
Load A and X	Pre–Indexed,X	LAX ($aa,X)	A3	2
	Post–Indexed,Y	LAX ($aa),Y	B3	2
	Absolute	LAX $aaaa	AF	3
	Absolute,Y	LAX $aaaa,Y	BF	3
LAN	Zero Page	LAN $aa	27	2
(ROLM)&A to A	Zero Page,X	LAN $aa	37	2
Rotate M left,	Pre–Indexed,X	LAN ($aa,X)	23	2
AND with A	Post–Indexed,Y	LAN ($aa),Y	33	2
	Absolute	LAN $aaaa	2F	3
	Absolute,X	LAN $aaaa,X	3F	3
	Absolute,Y	LAN $aaaa,Y	3B	3
	Immediate	LAN Imm	2B	2
RAD	Zero Page	RAD $aa	67	2
(RORM)+A+C to A,C	Zero Page,X	RAD $aa,X	77	2
Rotate M right,	Pre–Indexed,X	RAD ($aa,X)	63	2
Add with Carry	Post–Indexed,Y	RAD ($aa),Y	73	2
	Absolute	RAD $aaaa	6F	3
	Absolute,X	RAD $aaaa,X	7F	3
	Absolute,Y	RAD $aaaa,Y	7B	3
LOR	Zero Page	LOR $aa	07	2
(ASLM)OR A to A	Zero Page,X	LOR $aa,X	17	2
Shift M left,	Pre–Indexed,X	LOR ($aa,X)	03	2
OR with A	Post–Indexed,Y	LOR ($aa),Y	13	2
	Absolute	LOR $aaaa	0F	3
	Absolute,X	LOR $aaaa,X	1F	3
	Absolute,Y	LOR $aaaa,Y	1B	3
	Immediate	LOR Imm	0B	2
REO	Zero Page	REO $aa	47	2
(LSRM)EOR A to A	Zero Page,X	REO $aa,X	57	2
Shift M right,	Pre–Indexed,X	REO ($aa,X)	43	2
Exclusive OR with A	Post–Indexed,Y	REO ($aa),Y	53	2
	Absolute	REO $aaaa	4F	3
	Absolute,X	REO $aaaa,X	5F	3
	Absolute,Y	REO $aaaa,Y	5B	3

Name/Operation	Mode	M.L. Form	Op	Bytes
TEA (A&X&((>M)+1)) to M	Absolute,Y	TEA $aaaa,Y	9F	3
Increment the high byte of the address of M, AND with A AND X				
TEX (X&((>M)+1)) to M	Absolute,Y	TEX $aaaa,Y	9E	3
Increment the high byte of the address of M, AND with X				
AXM (A&X)–M to X	Immediate	AXM Imm	CB	2
AND A with X, subtract M, store in X				
RAM LSR(A&M) to A	Immediate	RAM Imm	4B	2
AND A with M, Shift right and store in A				
RBM ROR(A&M) to A	Immediate	RBM Imm	6B	2
AND A with M, Rotate right and store in A				
XMA AND X with M,(X&M)&(AOR#$EE) to A	Immediate	XMA Imm	8B	2
OR A with #$EE, AND the two resulting bytes and store in A				
TEY (Y&#$01) to M	Absolute,X	TEY $aaaa,X	9C	3
test bit 0 in Y				
AMA (M&#$EE)OR(A&M&#$11) to A	Immediate	AMA Imm	AB	2
LAS M to A, M to X, M to SP	Absolute,Y	LAS $aaaa,Y	BB	3
Store M in A, X, and SP				
AXS (A&X) to SP, (A&X&#$01) to M	Absolute,Y	AXS $aaaa,Y	9B	3
AND A with X, store in SP, AND SP with #$01, store in M				
NPA to **NPF**	Implied	NPA	1A	1
Identical with NOP	Implied	NPB	3A	1
	Implied	NPC	5A	1
	Implied	NPD	7A	1
	Implied	NPE	DA	1
	Implied	NPF	FA	1
MNA to **MNN**	Implied	MNA	04	2
Add #$02 to PC	Implied	MNB	14	2
	Implied	MNC	34	2
	Implied	MND	44	2
	Implied	MNE	54	2
	Implied	MNF	64	2
	Implied	MNG	74	2
	Implied	MNH	D4	2
	Implied	MNI	F4	2
	Implied	MNJ	80	2
	Implied	MNK	82	2
	Implied	MNL	89	2
	Implied	MNM	C2	2
	Implied	MNN	E2	2
DNA to **DNG**	Implied	DNA	0C	3
Add #$03 to PC	Implied	DNB	1C	3
	Implied	DNC	3C	3
	Implied	DND	5C	3
	Implied	DNE	7C	3
	Implied	DNF	DC	3
	Implied	DNG	FC	3
SBC	Immediate	SBC Imm	EB	2
Executes identically with the documented SBC op–code $E9				

CRA to **CRL**						
Processor halts, must	CRA	02	CRE	42	CRI	92
be hardware reset	CRB	12	CRF	52	CRJ	B2
	CRC	22	CRG	62	CRK	D2
	CRD	32	CRH	72	CRL	F2

6510 Opcodes

Raymond Quirling
Kerby, OR

Editor's Note: *These next two articles came in the same batch of mail. They're both about further investigation of the undocumented op-codes. They both have an intersection set of data, but each had other additional observations and examples that we didn't want to exclude. Besides, the two tables together make a good cross reference, considering there are no official specs.*

People who investigate undocumented opcodes deserve all the headaches they get! I started with Joel Shepherd's list in Oct 83 Compute! and discovered a few weird things. Now Jim McLaughlin's list in Transactor Vol 6, Issue 3 has added a few more surprises. I thought I had done everything right but McLaughlin proved me wrong. But after I looked over the list again I still come up with a few disagreements with Jim's list. If he and I are both right it could mean that different 6510's have different responses to the undocumented codes.

The attached listing (page 56) is marked with asterisks where I still disagree with Jim. The first column is Jim's mnemonics (as he listed the code). The 1st operation is performed on the address contents, then the second operation is performed on the new contents. Parenthesis indicate that something non standard is going on.

CB (acm) produces CMP flags: v (overflow) is not affected. 0B (ann) and 2B (ann) are identical and very similar to the normal AND opcode. The c flag is weird and I did not detect any shifting of the immediate location. The clock cycles Jim found also point to a simple AND function. 6B (arr) has some really weird flags! It is not safe to make assumptions about how the flags work. 8B (oxa) and AB (oxx) are both affected by the strange ORA #$EE. 89 (skb) is a two byte nop for me, but it does look out of place.

BB (lsa) and 9B (lss) both affect the stack. Neither McLaughlin nor Shepherd indicated this, but Jim did note his difficulty in timing BB (probably impossible to do with the stack flitting about). But the most weird of all is the $zz store operation that affects five opcodes 93 (axs), 9B (lss), 9C (yas), 9E (xas) and 9F (axs). Shepherd noted the effect on 9F and 9E but was unable to determine the source of the operand for the mysterious AND operation. I figured it out after noting that my operand was different than Joel's and changed after switching to a different memory location to do the testing. After McLaughlin failed to note the effect I repeated it and discovered the surprising result when a page boundary is crossed.

I counted 105 undocumented 6510 opcodes from pages 256 through 259 of the "Commodore 64 Programmer's Reference Guide". They were tested one by one using Butterfield's Supermon. Flag changes were pure drudgery to document. Sorry, no 6502 comparisons. I retained the three character mnemonic description even though it isn't always informative with some of the more involved operations. I liked Jim's skip mnemonics but prefer dth (death) to his CIM (crash immediate). Pick your own personal mnemonics to taste!

The "death" opcodes are suspicious. What trickyness lies hidden therein? Are they interrupts or subroutine calls to an infinite loop? Maybe the kernal is dropped out? I looked for changes to memory, including the stack area, without success.

Are these codes safe to use? That is, can you write software using the new codes for use in other C–64's or with the new C–128? Some of the codes appear to be "accidental" rather than planned. These might change when going from one generation chip to another, or even from one 6510 to another. All the NOP's, SKW's and SKB's fit this category. Be safe! check it out!

I have installed the new opcodes in a disassembler written in Basic. (No assembler yet.) It is available to anyone who sends a disk with return postage to R. Quiring, P.O. Box 135, Kerby, OR 97531.

Legend

ar,xr,yr	register contents	M	contents of address
sp	stack pointer	!	logical OR
c,z,n,v	status flag bits	&	logical AND
$zp	zero page address	=	equals, or 'is assigned to'
#$nn	immediate value	*	indicates disagreement
$addr	absolute address		with McLaughlin findings

$zz explanation

Used by 93 axs ($zp),y
9b lss $addr,y
9c yas $addr,x
9e xas $addr,y
9f axs $addr,y

$zz = msb(addr)+1
memory = address mode: M = $zz&(opcode specific value)
If a page is crossed then (surprise):
memory = M * $100 + lsb(address mode)

Example using 9b lss $addr,y:

ar	xr	sp	addr	yr	addr,y	memory	zz	M	
3f	ff	3f	500f	00	500f	500f	51	11	(ar&xr&$zz)
3f	ff	3f	500f	f0	50ff	50ff	51	11	
3f	ff	3f	5010	f0	5100	1100	51	11	
3f	ff	3f	500f	f1	5100	1100	51	11	
3f	ff	3f	5011	f0	5101	1101	51	11	

Example using 93 axs ($fc),y: 00fc=0f, 00fd=50:

ar	xr	sp	addr	yr	($zp),y	memory	zz	M	
ff	3f	xx	500f	f0	500f	50ff	51	11	(ar&xr&$zz)
ff	3f	xx	500f	f1	5100	1100	51	11	

Example using 9c yas $500f,#$f1:

ar	xr	sp	addr	yr	addr,x	memory	zz	M	
ff	f1	xx	500f	3f	5100	1100	51	11	(yr&$zz)

The Undocumented 6500 Series Instructions: A Summary

Noel Nyman
Seattle, WA

Editors Note: *To make this article complete, I felt it best to print Mr. Nyman's opening letter enclosed with the article, to act as a qualifier of the data presented today. After reading his letter, I am sure you will feel that Mr. Nyman is quite adequately qualified to reach the conclusions he has. As a note from us, Noel, thanks for thinking of us. Noel's table has been reproduced on page 57*

Letter by Noel Nyman

I was very interested in "Hidden Op–Codes" by Jim McLaughlin in Transactor 6–03.

Several months ago I and other local programmers worked on these undocumented op–codes for Reflexive Software. The block editor in their Disk Maintenance package will optionally disassemble these op–codes.

While doing the research, we tried most of the codes on several different 65XX series MPU's, including those in PET's, VIC–20's, C64's, Plus4, and an APPLE II. We tried to find 65XX's made by Synertek or Rockwell, the two licensees of MOS Technologies, without success.

All of the op–codes we tested worked identically on all the MPU's we tried.

Mr. McLaughlin's four 'peculiar' codes worked reliably for us on different MPU's, although they gave us different results than his. Readers can easily test the codes by using any ML monitor, storing the short programs on the following pages into memory using the 'M' command, then executing the code with either 'Go' or 'Walk' and examining the registers and memory locations afterwards.

Mr. McLaughlin's chart lists two op–codes which he did not discuss, $9E and $9F. He lists as a reference the Joel Shepherd article "Extra Instructions" in the October 1983 COMPUTE! This was the first source we found that gives a function for these two codes.

Shepherd states that the two codes AND registers in the 65XX with $04, although he didn't know where the $04 came from. The Complete Commodore Inner Space Anthology lists these op–codes with the same explanation.

The code will execute much as Shepherd describes, so long as the absolute memory location is in $03 page. I suspect that Shepherd and his predecessors have used the tape buffer for their test code. The $9E and $9F instructions actually use absolute indexed Y addressing and AND the respective registers with the high byte of the memory ADDRESS plus one.

For example, place the test code in the tape buffer area, $033C and use memory address $0350. The results are as Shepherd and the Anthology report, $04 will appear at location $0351 (Y is loaded with $01 for the test). Now change the memory address to $7050 and execute the code. A $71 appears at location $7051.

The whole subject of undocumented op–codes is probably at best a curiosity. I've heard that some commercial programs use these codes for security, both West and Butterfield have said so. But I've yet to see an example. I'd be very interested in any differences from our list your readers encounter.

I'm including a copy of the chart we made for Reflexive Software which we believe to be accurate. For your convenience, I've included a disk with the chart, this letter, and the attached pages in EasyScript files.

Sincerely, Noel Nyman, Seattle WA

Some example using Noel's notation follow on the next page.

A Few Examples

$8B (X&M)&(AV#$EE) to A (Immediate)

AND X with M, AND the result with (A OR $EE) and store in A

Sample code:

```
CLC
LDA #$00
LDX #$FF
XAA #$FF
BRK
```

From memory mode, store:

```
. 18 A9 00 A2 FF 8B FF 00
```

After executing, examine the A register.

$9B (A&X) to SP (A&X&#$01) to M (Absolute,Y)

AND A with X and store in Stack Pointer. AND Stack Pointer with #01 and store in M.

Sample code:

```
CLC
LDA #$0F
LDA #$07
LDY #$01
XAA $00FB,Y
BRK
```

From memory mode store:

```
. 18 A9 0F A2 07 A0 01 9B
. FB 00 00
```

Before executing code, use the 'Register' mode of the monitor to change the Stack Pointer to $FF and location $00FC to $00. After execution, check the Stack pointer and $00FC.

$BB M to A, M to X, M to SP (Absolute,Y)

Store M in A, X, and SP

Sample code:

```
LDX #$00
LDA #$0F
STA $FC
TXA
LDY #$01
LAS $00FB,Y
BRK
```

From memory mode store:

```
. A2 00 A9 0F 85 FC 8A A0
. 01 BB FB 00 00
```

Before executing, use the 'Register' mode of the monitor to change the Stack Pointer to $FF. After execution, check A, X and the Stack Pointer.

$EB A–M to A (Immediate)

Subtract M from A and store in A. This executes identically with the documented SBC code $E9

Sample code:

```
SEC
LDA #$80
SBD #$01
BRK
```

From memory mode store:

```
. 38 A9 80 EB 01 00
```

After executing code, examine A.

$9F (A&X&((>M)+1) to M (Absolute,Y)

Increment the high byte of the address of M, AND with A AND X, store in M.

Sample code:

```
LDA #$FF
LDX #$FF
LDY #$01
MKA $7050,Y
BRK
```

From memory mode, store:

```
. A9 FF A2 FF A0 01 9F 50
. 70 00
```

After executing, examine memory location $7051. If you change the $70 to $30 you'll duplicate the code as described by Shepherd.

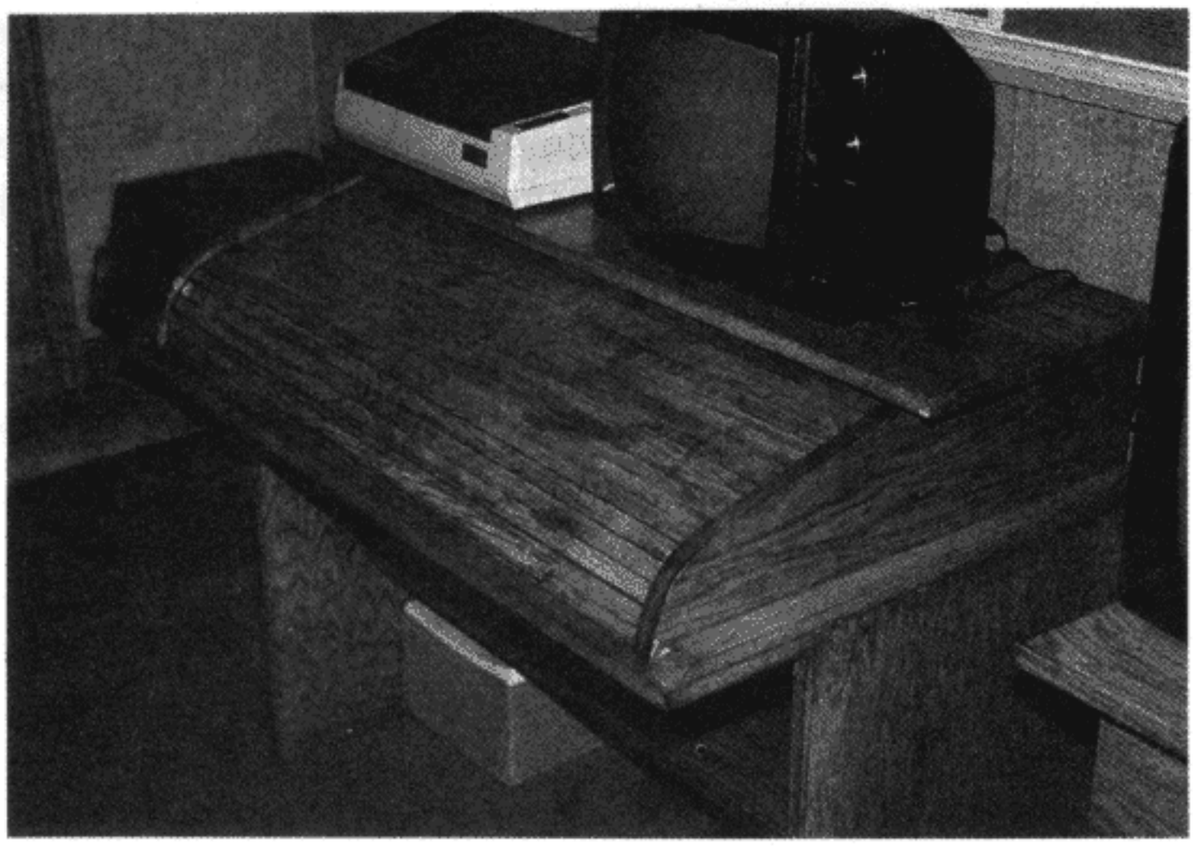
$9E (X&((>M)+1) to M (Absolute,Y)

Increment the high byte of the address of M, AND with X, store in M.

To test, use the sample code for $9F and change the op–code to $9E.

A Computer Rolltop Stand

Mark Jordan
Ligonier, IN



. . .Not only order, but the *appearance* of order even if there is none.

Until I built this rolltop computer stand, I was like most of the other computer people I know — disorganized. I had my black and white TV "monitor" mounted on a couple of thick books, sitting behind my 64, my disk drive to the left. Books, magazines, disks and other hi-tech refuse were strewn about. This provision worked until I brought home a printer. I shoved my disk drive over thisaway, moved my TV over thataway, and dropped my printer down on the only bare acreage I could find. A complex array of cords and wires were then tied with little twistee things and carefully positioned behind the desk where everything was sitting to allow space for my paper to snake through. I sat down to compute.

It was too crowded. Reference books were on the floor, opened. Disks were propped between TV and disk drive where magnetic fields are strongest. Demonstrating the printer to my technologically-unsophisticated wife was embarassing: the paper kept tearing en route to the printer. This put me in a snapping bad mood.

I decided I must build a desktop stand to put some order in my life. The rolltop model depicted here is the result. The stand itself does wonders for my desktop organization but what really makes this piece a winner is the rolltop design. I now am a zealot proclaiming the virtues of having a two-tiered, rolltop computer workplace.

You don't have to be a carpenter or fine woodworker to build one. Basically the project consists of five parts. Only two are tricky: routing a groove for the tambour (the sliding part) to slide in and building the tambour itself. And even these two aren't *too* tricky.

The first order of business is to buy your wood. The only problem is, I can't tell you the exact dimensions because you are going to customize this stand to fit your workspace. But you can easily figure what lumber you'll need by performing the following simple calculations. Please refer to the exploded drawing (figure 1) throughout.

First, to simplify matters and to save you time and money, all the lumber in the project will be common stock. The sides will be two by eights, the brace a two by four, the top a twelve inch wide shelf piece, and the slats three-eights by three-quarter inch moldings.

To figure the length of the brace (C), simply subtract four inches from the top's length.

Finally, to determine the number and length of slats you'll need for the tambour, perform these calculations. Take half of the sides' **length** and add two inches. Now divide this number by .75. The result equals the number of slats you'll need since each slat will be three-quarters inch wide. The **length** of the slats will simply be the length of the brace plus three-fourths inch.

You may have to do some asking to find out just what is available for your slats. Be sure to ask about window and door moldings and lattice. If your yard doesn't carry anything that's three-eights inch thick by three-quarters inch wide, you can simply readjust your calculations for how many pieces you'll need and buy whatever widths they have. don't buy any pieces wider than one inch because you'll have difficulty with them negotiating the curve when they are sliding. Feel free to use as narrow of stock as they sell.

The next order of business is to buy (or scrounge) a piece of fabric to glue your tambour to. It needs to be tough material (denim is good) and it needs to be as big as your finished tambour will be.

You are now ready to start building. Cut all pieces to the proper length. Now refer to figure 1 and notice that the sides begin sloping on the top edge midway along its length (see point 1). Mark that spot on your piece. Next note point 2 on figure 1. It is located three inches up from the bottom of the front of the side piece. Mark this on your sides and then use a straightedge to connect points 1 and 2 and cut them along this line.

The curve is not official science. If you have good sanding equipment (like a belt or disk sander), then you might just sand a gentle curve. Lacking one, you could nibble away at the sharp corner first with a saw until you get it to the hand-sandable stage. Anyway, you need to end up with a nice flowing curve. And, you need to make both sides identical. So sand the finishing touches with the two pieces clamped together.

The tambour groove needs to be done next. You need a router unless you like chiseling. If you have a router with an adjustable guide, use it to make the groove. Lacking a good guide, make a template for the router to ride against and clamp it to the side piece while routing.

A word of caution here. Routing is to woodworking what the GO and RUN commands are to programming. Things happen fast and sometimes, stuff gets messed up. That's why smart programmers save their work before a Go or RUN and that's why smart woodworkers only take a little wood at a time when they rout. In fact, they first do a dry run, checking to see exactly where the bit will byte (sorry, I'm getting as sick of those puns as you are but you have to admit, it really fit there).

The depth and width of the groove are recorded in figure 1 but I'll repeat them here: one-half inch by one-half inch. This will allow for just enough slop in your tambour for it to slide easily.

Now, on to the top. Cut it to size and it's done.

Now, on to the brace. Cut it to size and it's done.

Now, on to the tambour. Cut all the slats to size and lay them together tightly on a large sheet of scrap plywood or anything flat. Next tack down a couple of scrap wood pieces to keep them tight and square. Get some Elmer's Glue-All or other wood/fabric glue, pour it all over the slats, rub it around with your fingers until the slats are well covered, and take your piece of fabric and lay it onto this gooey surface. Press it down until you are sure the fabric has made full contact. Keep pressing until the fabric stays put (about fifteen minutes).

Let the tambour dry for a day.

Assembly time. Stand the sides on edge and set the top on it. Position the sides so that you allow a one-inch overhang of the top to the sides. Square everything up, then carefully remove the top and apply glue to the top edge of the side pieces. Carefully replace the top, re-square everything and either screw or nail the top in place. For looks, if you screw it down, be sure to countersink the screws so that you can cover them later with dowels or putty.

Now lay a bead of Elmer's on the top edge of the back brace and slip it up between the sides and under the top. It will be flush with the back of the top and sides (see figure 2). Nail or screw it from the top.

Finally, take your tambour and guide it up into the open groove from the bottom of the sides at the front and slide it all the way up and back. You will find it extends out about an inch from the top piece. If you wish, you can fashion a handle to pull the tambour with (see finished drawing), or you can just pull on the tambour itself. A handle is nothing more than a piece of molding glued to the bottom slat in the tambour.

Except for the finished work (sanding, staining, varnishing, etc.) you are done. Before doing any of that dreary stuff, hustle your new computer addition into the house and set it on your desk. Put everything the way you want it. Instant organization.

Now for the clincher. Pull down the tambour and, Eureka! everything is hidden. Your desk looks neat. All disks, books, Coke cans—everything—is hidden beneath that wonderful sliding front.

Well, it just goes to show you, there are some bargains left in life. You built this stand to organize your work station, and you got not only order, but also, the *appearance* of order even when there is none. And you got it all for only a few hours labor. Now that's what I call a good deal.

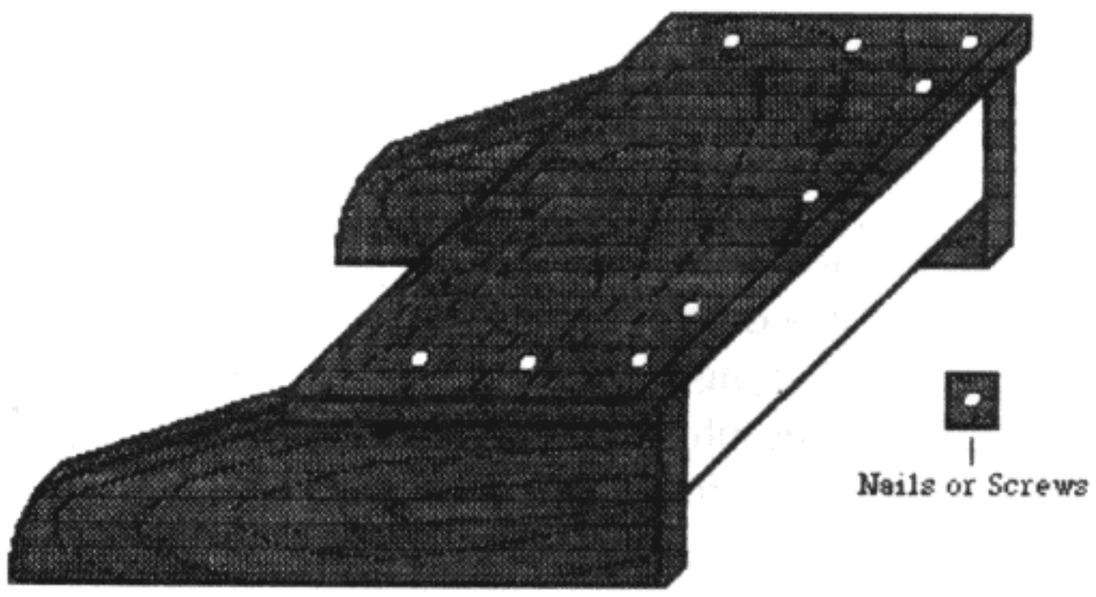
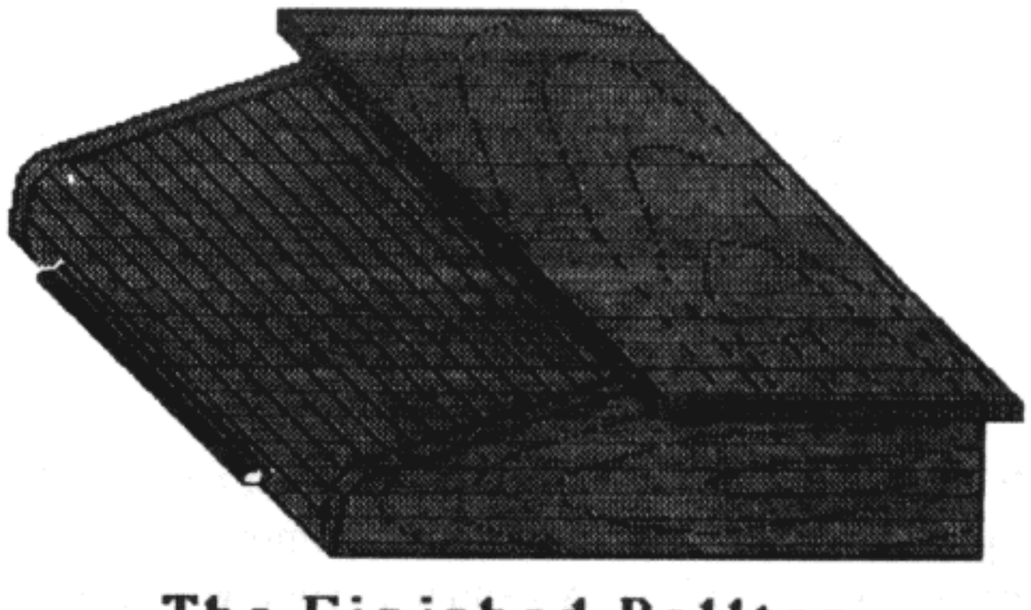
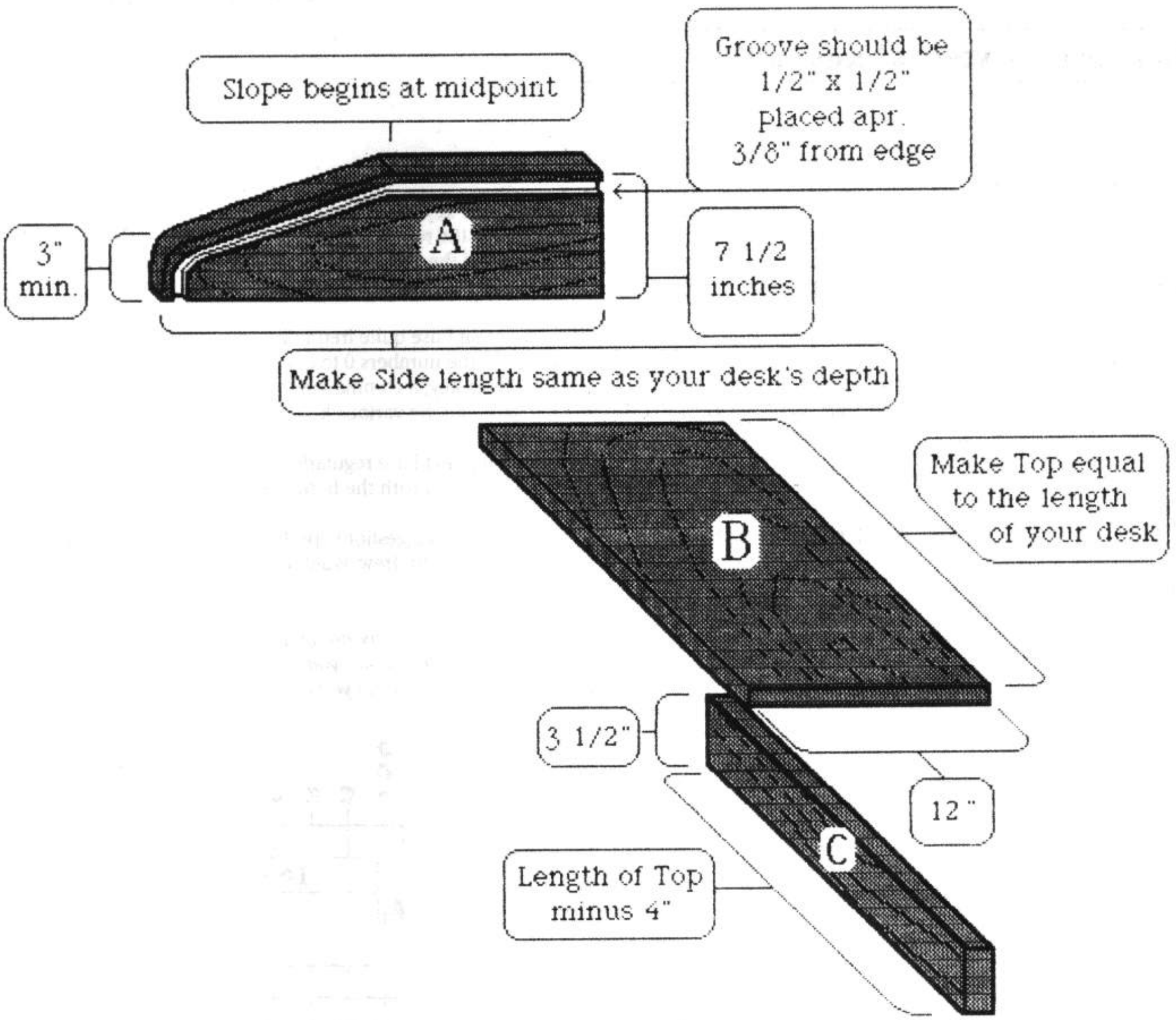


Figure 2



The Finished Rolltop



Exploded View of Rolltop Assembly

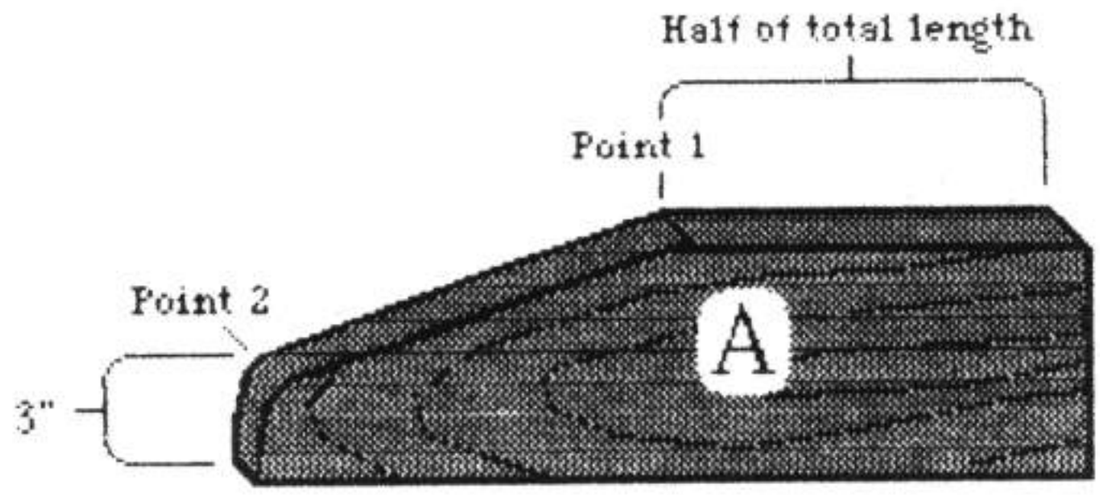


figure 1

Superkey

Andrew Walduck
Orillia, Ontario

A Homebrew External Keypad

If you've ever used a PET computer you know how nice it is to have a numeric keypad at your beck and call. You can blitz through data statements, whiz through number crunching and blast through line numbers. Now you can have this for your 64 and more. Superkey adds 16 new keys to your 64 that repeat, are redefinable and available for your use in either program or direct modes, and the best part about it is that it will cost you under $30.

Superkey Hardware

Superkey is designed around 1 major integrated circuit, a 74154 TTL 4 line to 16 line decoder. What a 74154 does is take the 4–bit binary number on its inputs (coming from the joystick port) and makes the corresponding output low and keeps all other outputs high. If the switch on that line is closed, the low signal is applied to the input of the joystick port where the software can tell if that key is pressed.

Superkey Software

The Superkey software is tied into the IRQ vector so that it is operated 60 times every second. The first thing it does is see if the keyboard buffer is full. If it is, it jumps to the normal interrupt routine. If not, the software sequentially writes the numbers from 0 to 15 into the second joystick port register, reading the status of the 4th bit each time. If it is low, it means that a key is pressed and the software then stores the correct character in the keyboard buffer.

Building Superkey

To build Superkey you will need the following parts

1 74154 4 line to 16 line decoder
1 16–key keypad (jameco part# k–19 is good)
1 d–9 socket (joystick port socket)
1 24 pin ic socket
miscellanous items
wire, solder, blank printed circuit board

After constructing Superkey according to the schematic, double check the wiring to make sure that it is correct and then plug it into joystick port 2 and turn the computer on. If the computer doesn't power up in the usual fashion, check your wiring again. If all is ok so far, press and release all of the 16 keys individually. None of them should have any effect on the screen. If any do, once again check the wiring of the circuit.

Type in and run the following program (don't forget to save it). If no error message is printed, make sure the keypad is plugged into joystick port 2 and enter:

```
SYS 49152
```

to enable Superkey. Now pressing the keys on the keypad should have an effect on the screen (ie "0" on the keypad should print 0 on the screen). If something appears wrong, recheck the program and the wiring of the keypad. To disable Superkey enter:

```
SYS 49155
```

Suggestions

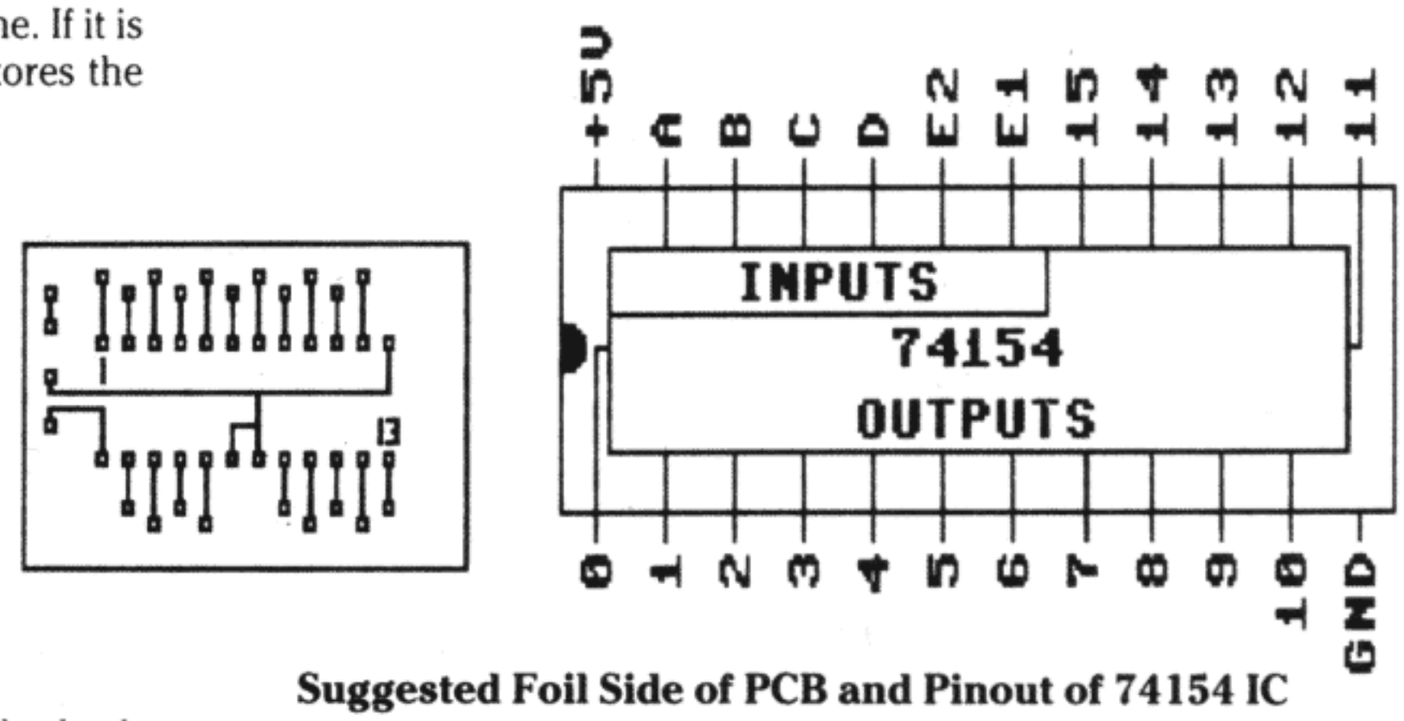
To change the keycodes that Superkey prints, change the data statements beside the rem statements that tell you the key number, to the ASC() value of the character you would like printed when that key is pressed.

One setup that I use quite frequently for entering data statements is a keypad with the numbers 0 to 9, a return key, a "d" key , a shifted "a", the delete key, a comma key, and the shift–return key. To do this merely, redefine the various keys on the keypad.

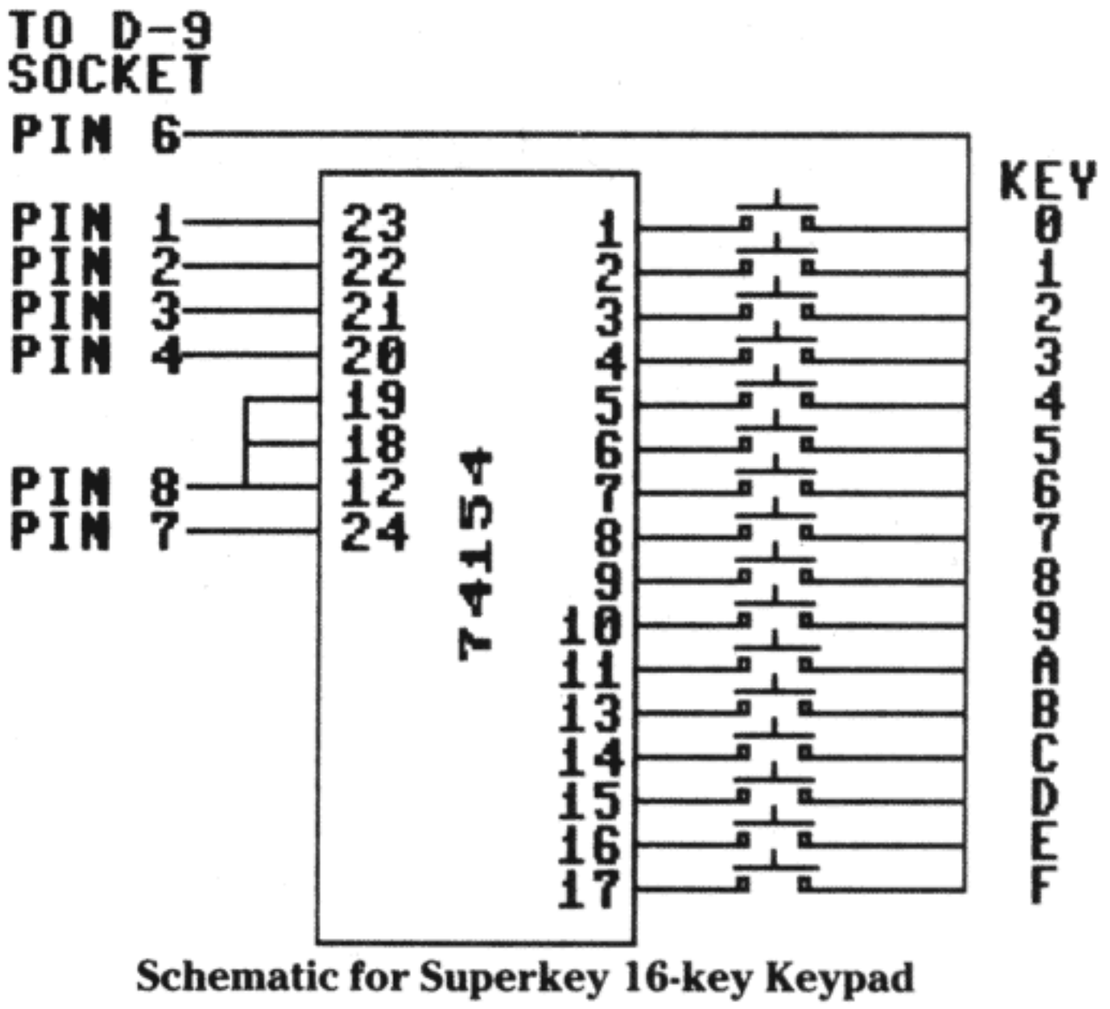
Another setup that I use regularly is one with the cursor keys set up in a diamond pattern with the home key in the center.

If you have any suggestions, problems or ideas regarding Superkey please write me. Andrew Walduck, 441 Barrie Rd #52, Orillia, Ontario, L3V 6T9

Editor's Note: *You may not end up building Andrew's keypad, but the program shows how you would service the joystick port in machine language should you ever need to.*



Suggested Foil Side of PCB and Pinout of 74154 IC



Schematic for Superkey 16-key Keypad

Superkey Basic Loader

```
GI  10 rem* superkey *
CJ  20 rem* software driver for ext. keypad
CJ  30 :
BA  40 fori=49152to49266:readda:ck=ck+da:pokei,da:nexti:fori=49267to49281:readda
HN  50 pokei,da:nexti:ifck<>14190thenprint" error in data statements" :end
IG  60 print" superkey now in memory $c000 to $c081 " :print" sys 49152 to activate "
FH  70 print" sys 49155 to deactivate " :end
EM  80 :
FO  1000 data  76,  18, 192, 120, 173, 112, 192, 141
FN  1010 data  20,   3, 173, 113, 192, 141,  21,   3
AP  1020 data  88,  96, 120, 173,  20,   3, 141, 112
FI  1030 data 192, 173,  21,   3, 141, 113, 192, 169
KB  1040 data  47, 141,  20,   3, 169, 192, 141,  21
OD  1050 data   3, 169,  16, 133, 254,  88,  96, 173
LD  1060 data 137,   2, 197, 198, 240,  57, 169,  15
CP  1070 data 141,   2, 220, 160,   0, 140,   0, 220
HC  1080 data 173,   0, 220,  41,  16, 208,  28, 196
GN  1090 data 254, 208,   8, 198, 253, 208,  27, 169
MF  1100 data   4, 208,   2, 169,  20, 133, 253, 185
MI  1110 data 114, 192, 166, 198, 157, 119,   2, 230
JM  1120 data 198, 208,   5, 200, 192,  16, 208, 213
NO  1130 data 132, 254, 169, 255, 141,   2, 220,  76
DP  1140 data  49, 234
CP  1150 :
```

```
LK  1160 rem* key definitions follow *
OK  1200 data 48 :rem key #0
PL  1210 data 49 :rem key #1
LK  1220 data 50 :rem key #2
ML  1230 data 51 :rem key #3
NM  1240 data 52 :rem key #4
ON  1250 data 53 :rem key #5
PO  1260 data 54 :rem key #6
AA  1270 data 55 :rem key #7
BB  1280 data 56 :rem key #8
CC  1290 data 57 :rem key #9
PM  1300 data 65 :rem key #10
BO  1310 data 66 :rem key #11
DP  1320 data 67 :rem key #12
FA  1330 data 68 :rem key #13
HB  1340 data 69 :rem key #14
EA  1350 data 70 :rem key #15
```

Superkey PAL Source Code

```
EO  100  sys700  ;pal 64 assembler
MP  110  ; superkey driver program
JG  120 * =          $c000
KO  130  .opt oo
CA  140  ;
PB  150  bufnum  =   198
DC  160  bufmax  =   649
NN  170  datapt  =   $dc00
GL  180  ddr     =   $dc02
MD  190  keybuf  =   631
EF  200  irqvec  =   788
AB  210  cntr    =   $fd
HP  220  pkey    =   $fe
OG  230  delay   =   20
OO  240  rpt     =   4
PK  250  lkey    =   16
KH  260  ;
KL  270          jmp   setup          ;connect
JO  280          sei                  ;disconnect
HB  290          lda   oldirq+1
FN  300          sta   irqvec
PC  310          lda   oldirq+2
LK  320          sta   irqvec+1
IN  330          cli
AE  340          rts
EN  350  ;
IH  360  setup   sei
NN  370          lda   irqvec
PK  380          sta   oldirq+1
DL  390          lda   irqvec+1
HM  400          sta   oldirq+2
FL  410          lda   #<start
NE  420          sta   irqvec
FM  430          lda   #>start
DC  440          sta   irqvec+1
DD  450          lda   #lkey
```

```
LI  460          sta   pkey
EG  470          cli
MM  480          rts
AG  490  ;
LD  500  start   lda   bufmax
GG  510          cmp   bufnum         ;check if keybuffer full
NL  520          beq   oldirq         ;branch if yes
BL  530          lda   #%00001111
PL  540          sta   ddr            ;set up data direction register
IL  550          ldy   #$00           ;start key count at zero
LC  560  kread   sty   datapt         ;store count in port 2
BM  570          lda   datapt
BC  580          and   #%00010000     ;check if key pressed
DK  590          bne   nokey          ;branch if not pressed
EN  600          cpy   pkey           ;is current key same as last
EP  610          bne   not            ;branch if not the same
LA  620          dec   cntr           ;decrement count until repeat
IC  630          bne   reset          ;branch if not time for repeat
PO  640          lda   #rpt
BL  650          bne   store
IB  660  not     lda   #delay
PK  670  store   sta   cntr           ;set up counter for next repeat
KB  680          lda   table,y        ;lda with character from table
DD  690          ldx   bufnum         ;current key in keybuffer
NB  700          sta   keybuf,x       ;store char
GK  710          inc   bufnum         ;add 1 to # of chars in buffer
AG  720          bne   end            ;branch always!
BL  730  nokey   iny                  ;add 1 to current key number
EB  740          cpy   #lkey          ;is loop doneprint
NM  750          bne   kread          ;branch if not done
OA  760  end     sty   pkey           ;save y in previous key pressed
MG  770  reset   lda   #%11111111
CO  780          sta   ddr            ;restore data direction registr
GH  790  oldirq  jmp   $ea31          ;go to old irq routine
CI  800  table   .asc "0123456789abcdef"
MC  810  ;table of characters for keys
AB  820  .end
```

String Calc

Daniel Bingamon
Batavia, Ohio

Here is a simple and yet transportable program written in Basic for evaluating expressions in strings.

The program will evaluate the string in a left to right order (not algebraically) like the way you would enter it on a very simple calculator. The program is shown below with a description of what each section does:

First, a simple screen clear.

```
10 printchr$(147)
```

The user is prompted for a formula, passed from a different subroutine instead of the input statement.

```
20 input " enter formula " ;f$
```

Program is terminated if stop is typed.

```
30 iff$ = " stop " thenstop
```

The variable " A " will be used as an accumulator for the result.

```
40 a=0
```

A space is put on the end of the formula as a terminator in case the user did not supply one. " P$ ", Is the work string for the parser and " ID " is flag which determines what type of operation will be performed, " 9 " is the initial mode. " DN " is the finish flag.

```
50 f$=f$+ "  ":p$=f$:id=9:dn=0
```

This loop looks to see the length of an element by looking ahead for the next separator character (space). If it not found then an error message occurs. An error should not occur on line 70 since line 50 insures against it.

```
60 fori=1tolen(p$)
65 ifmid$(p$,i,1)= "  " then80
70 next:print " ?invalid formula " :goto20
```

Now a check to see if the program finished flag should be set by determining if the pointer to the end of formula matches the size of the formula.

```
80 ifi=len(p$)thendn=1
```

Set up string from the work string to the next separator (space).

```
90 x=i:x$=left$(p$,x)
```

Set value flag on. The Value flag off means that the next character is a symbol. If it is a value then the amount will be placed in the variable " V ".

```
100 va=1:v=val(x$)
```

If the contents of X$ is not a value then set the value flag back to off.

```
105 ifval(x$)=0andleft$(x$,1)<>" 0 " thenva=0
```

If the symbol is a PI symbol or the word PI then toss PI into V and set value flag back to on.

```
110 ifleft$(x$,2)= " pi " thenv=3.14159265:va=1
120 ifleft$(x$,1)= " π " thenv=3.14159265:va=1
```

If value flag is on then goto process value routine otherwise find out what type of symbol is used.

```
130 ifva=1then230
```

Handle subtotals.

```
135 ifleft$(x$,1)= " ' " thenprint " st =  " ;a:goto310
```

Load first position into string and compare.

```
140 id$=left$(x$,1):id=0
```

Compare to possible symbols and set up a symbol code.

```
150 ifid$= "  +  " thenid=1
160 ifid$= "  -  " thenid=2
170 ifid$= "  *  " thenid=3
180 ifid$= "  /  " thenid=4
190 ifid$= "  ↑  " thenid=5
```

If symbol could not be found then spit out error.

```
195 if(id>0)and(id<90)andmid$(x$,2,1)<>"    " then
    print " ?error " :goto20
```

Skip over extra spaces.

```
200 ifid$= "    " then310
```

If accumulator is still zero then skip test for rounding.

```
203 ifa=0then210
```

Round by tens requested?

```
204 ifid$ = " @ " thenam = val(mid$(x$,2,1))
    :am = –am:goto207
```

Round by tenths requested?

```
205 if id$<> " ; " then210
```

Round by raising to the specific power to make the affected position lie in the tens position, add .5 to the number, truncate and reverse the process to take the number back to original power.

```
206 am = val(mid$(x$,2,1)):ifa = 0then210
207 a = int(a*(10↑am) + .5):a = a/(10↑am)
    :id = 0:goto310
```

If no ID code for symbol found then it must be an invalid symbol, spew out error message.

```
210 ifid = 0thenprint " ?bad symbol " :goto20
```

Symbol processed. Get then next element. Normally it should be a value unless, the accessory functions such as rounding or subtotals are used.

```
220 goto310
```

Take the accumulator and the value being processed and merge them by the instruction code created by the Symbols.

```
230 ifid = 1thena = a + v
240 ifid = 9thena = v:id = 0:goto310
250 ifid = 0thenprint " ?error " :got20
260 ifid = 2thena = a–v
270 ifid = 3thena = a*v
280 ifid = 5thena = a↑v
```

Division by zero trap.

```
290 ifid = 4andv = 0thenprint " ?div by zero " :goto20
300 ifid = 4thena = a/v
```

If done flag set exit here to show result and request new formula.

```
310 ifdn = 1then330
```

Move forward to the next element by removing the old elements as we go along.

```
320 p$ = right$(p$,(len(p$)–len(x$))):goto60
```

Display result and clear accumulator.

```
330 print " result =  " ;a:a = 0:goto20
```

Sure, it doesn't do everything the internal machine language routine that evaluates expressions in your Commodore computer does but, it helps give you a BASIC idea on how a computer can perform these functions. The program can be used in a number of applications and might even be expanded to give some operations priority and even process the parenthesis ( ) symbols.

String Calc, uninterrupted

```
10 printchr$(147)
20 input " enter formula " ;f$
30 iff$ = " stop " thenstop
40 a = 0
50 f$ = f$ +  "    " :p$ = f$:id = 9:dn = 0
60 fori = 1tolen(p$)
65 ifmid$(p$,i,1) = "    " then80
70 next:print " ?invalid formula " :goto20
80 ifi = len(p$)thendn = 1
90 x = i:x$ = left$(p$,x)
100 va = 1:v = val(x$)
105 ifval(x$) = 0andleft$(x$,1)<> " 0 " thenva = 0
110 ifleft$(x$,2) = " pi " thenv = 3.14159265:va = 1
120 ifleft$(x$,1) = " π " thenv = 3.14159265:va = 1
130 ifva = 1then230
135 ifleft$(x$,1) = " ' " thenprint " st =  " ;a:goto310
140 id$ = left$(x$,1):id = 0
150 ifid$ = "  +  " thenid = 1
160 ifid$ = " – " thenid = 2
170 ifid$ = " * " thenid = 3
180 ifid$ = " / " thenid = 4
190 ifid$ = " ↑ " thenid = 5
195 if(id>0)and(id<90)andmid$(x$,2,1)<> "    " then
    print " ?error " :goto20
200 ifid$ = "    " then310
203 ifa = 0then210
204 ifid$ = " @ " thenam = val(mid$(x$,2,1))
    :am = –am:goto207
205 if id$<> " ; " then210
206 am = val(mid$(x$,2,1)):ifa = 0then210
207 a = int(a*(10↑am) + .5):a = a/(10↑am)
    :id = 0:goto310
210 ifid = 0thenprint " ?bad symbol " :goto20
220 goto310
230 ifid = 1thena = a + v
240 ifid = 9thena = v:id = 0:goto310
250 ifid = 0thenprint " ?error " :got20
260 ifid = 2thena = a–v
270 ifid = 3thena = a*v
280 ifid = 5thena = a↑v
290 ifid = 4andv = 0thenprint " ?div by zero " :goto20
300 ifid = 4thena = a/v
310 ifdn = 1then330
320 p$ = right$(p$,(len(p$)–len(x$))):goto60
330 print " result =  " ;a:a = 0:goto20
```

Getting On Viewtron: It's This Easy!

First, you need the Viewtron Starter Kit. If you live in the U.S. you can call their toll free number:

Viewtron
1 800 272 5400
1111 Lincoln Road, 7th Floor
Miami Beach, Florida
33139

It's just $9.95 and it comes with handy 46-page reference guide, a disk with software that works superbly, and an hour of Viewtron free.

Viewtron is fast, flexible, versatile, capable, and, it's in color! With a nice color monitor, some of the screens are rather pleasing. The software is somewhat specialized for the NAPLPS videotext protocal, but it can download, send to printer, re-dial, plus lots of other stuff – it's all in the manual.

Canadian orders that get stuck in customs can take as long as six weeks to get to you from Miami. Instead, let us send you one – it's about the same price after exchange and you can use our postage paid subscription form. See News BRK for more details.

The simplest part about Viewtron has to be signing on. The disk is 4040/1541 format. You LOAD " * " ,8,8 (or ',8,1' if you like) and you'll get two options. 1 to sign on, 2 for set-up. Once you get the Viewtron software set up with your ID and Password, hit 1 for sign-on and the program does the rest. If you don't have an auto dial modem you'll need to call your local network manually, but after that the program does the rest. It pumps out the Viewtron call address for you, followed by your ID and Password. The first screen you see is the main index which informs you of any new mail, current events, and away you go. You're On!

Setting Up For Viewtron

The "set-up" option will rarely be used more than once. Before loading the Viewtron software, however, you should first load another program that comes on the disk:

```
load "phone",8,8
run
```

Enter your area code and a list of phone numbers will be displayed for the major telecommunications networks (see below). You can access Viewtron from any of these networks so pick a number (preferably a local call) and write it down along with the network it belongs to. Some numbers may not appear in this list but it's easy to change these parameters should you find ways to fine tune your software later on (ie. more local call or 1200 baud line).

Now load the Viewtron program (load " * " ,8,8) and choose option 2. The menu will show three sections that need to be completed.

1: Modem

The following has been reproduced from the "set-up" option and should give you an idea of which modems are compatible with the Viewtron software.

1 Volksmodem 1200
2 Westridge 6420
3 Hesmodem I
4 Smartmodem
5 1064 Modem
7 Commodore 1660
8 More modems, takes you to:

1 Vicmodem 1600
2 64modem
3 Volksmodem 6420
4 Commodore 1650
5 Commodore 1670
6 Other auto (dialing) 1200
7 Other auto (dialing) 300
8 More modems, takes you to:

1 Manual 1200
2 Manual 300
8 More modems, repeats from start.

2: Built in Networks

1 Telenet
2 Uninet
3 LADT
4 Tymnet
5 Datapac
6 Other

Selecting any of the above will prompt for a phone #. This is the local number for the network you have chosen (which you may have found from the "phone" program earlier). Option 6 allows you to enter the phone number of any network, followed by the call sequence to access, theoretically, any service. However, the Viewtron software is somewhat specialized and compatibility with other online services, NAPLPS or otherwise, has not been tested.

3 ID and Password

Option 3 prompts for your Viewtron ID and Password from the card inside the Viewtron Pack. Enter these as shown but hang

on to the card – the ID and Password are sent automatically by the software when you sign on, but some sections of Viewtron will ask you for your password so keep it handy.

Once back at the menu, hit Return and everything will be stored to disk. Don't worry about mistakes, changes are easy. You can even change your password after you get your Viewtron account established.

Your First Time On Viewtron

Now select option 1: Sign–On. If you have an auto-dial modem, sit back and relax. If not, dial the number for your local network manually and wait for the connect tone. Signing on generally takes about 30 seconds but any more than a minute means try again – hit C= and R for Redial.

You'll be asked for your first name, your last name, address, etc., and get your credit card, you'll need that too.

Once Viewtron has all your particulars, you're ready to wander. You may find it strange to have 'New Mail' waiting for you since this is your first time on, but read it anyway for the experience. Try 'CB' – you'll be asked to enter your "handle" so you may want to think one up ahead of time. Try some of the other keywords listed in the manual. It doesn't take long and Viewtron will as easy as loading the software.

The Transactor is currently investigating the potential for a 'Transactor' section on Viewtron. Articles would be made available as well as programs for downloading. To get an idea of what a Transactor section might be like, try the Protecto (enter *protecto*) section. Entering *transactor* would take you to a similar screen where you would select from a number of options.

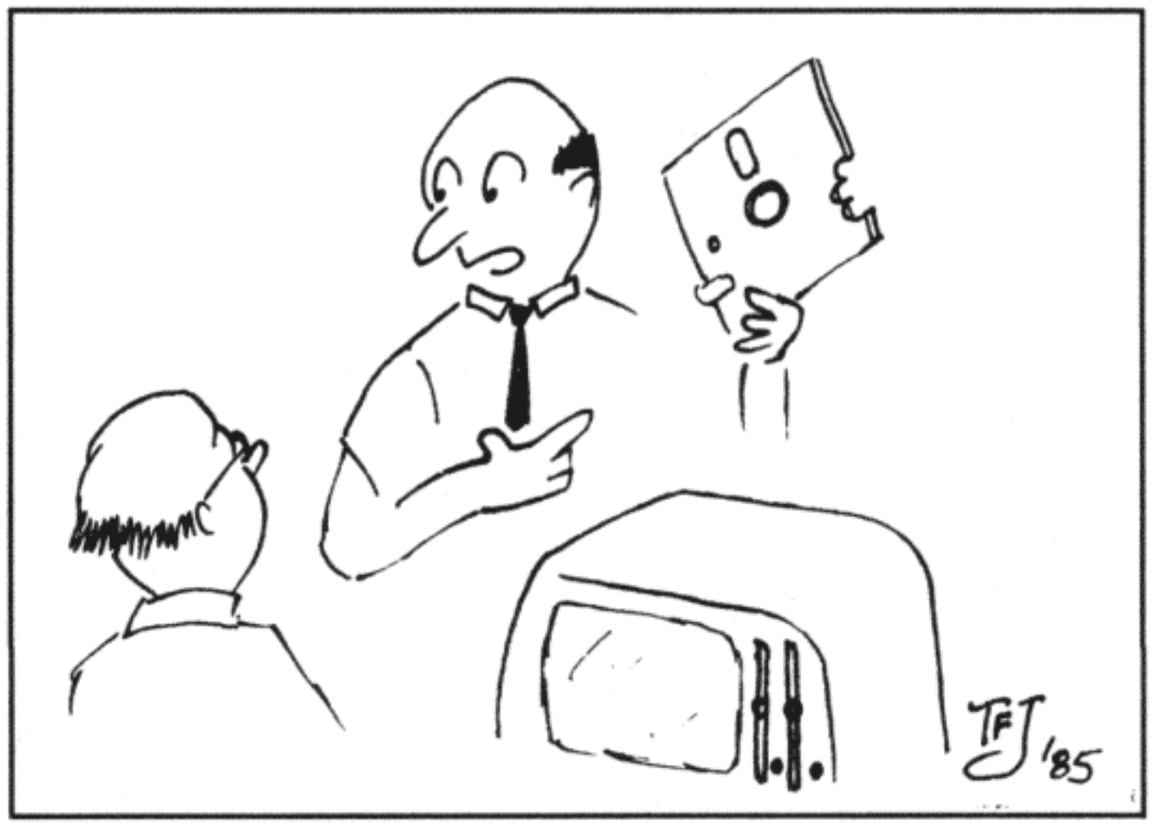
So check it out and let us know what you think. We'll have more about Viewtron next issue.

The SAVE@ Saga

If you've been following the SAVE@ saga you've probably read the brilliant investigative work of P.A.Slaymaker in Compute. Part 2 of Phillip's article uncovered some important missing pieces of the mystery. Unfortunately we didn't have time to make any additional study for this issue. Phil has agreed to make more of his discoveries available to us, including the code changes he discussed in Compute, hopefully by next issue.

The latest news, however, is that SAVE@ is equally offensive in the MSD drives (as noted by Roy Dancy, Dothan, AL) as well as the new Commodore 1571. It's interesting how the same bug can get from one DOS to another, even with two completely different manufacturers. Hmm.

Compu-toons



I told you this new anti-copy protection doesn't fool around.

"INPUT. . . OUTPUT. . . SHOT PUT"

©1985 DAN SCAN

CAPTAIN SYNTAX

RECAP: CAP'N SYNTAX HAS BEEN MIND CONTROLLED BY DOCTOR FLOTSKY'S ASSISTANT AND THE CAPTAIN'S SCIENTIST ALLIES HAVE BEEN CAPTURED DURING A SABOTAGE ATTEMPT ON FLOTSKY'S COMPUTER. IF THEY HAD SUCCEEDED, IT WOULD HAVE HELPED RENDER THE MIND-CONTROL CHIPS USELESS. ALL CLEAR? GREAT!

MICRO CHIP

HE SHOULD BE PLEASED WHEN HE ARRIVES!

NOK NOK!

AH! HE'S HERE!

HA HA!

AT LAST! CAPTAIN SYNTAX AND THE PRIME MINISTER UNDER DR. FLOTSY'S MIND CONTROL!

DOCTOR FLOTSY!

HELLO!

HELLO, JIM

I TRUST THAT THINGS ARE GOING WELL?

OF COURSE!

I HAVE CAPTURED THOSE SCIENTISTS WHO TURNED AGAINST ME!

TAKE 'EM INTO THE BACK ROOM, BOYS!

CAPTAIN SYNTAX! WELL, WELL! MY CONSTANT ANTAGONIST!

LET'S KILL HIM, DOCTOR!

AND SLOWLY!

SUDDENLY.....

...CAPTAIN SYNTAX REVERTS TO DISK FORM AND THEN TO HUMAN FORM... CAUSING THE MICRO CHIP TO FALL OFF!

OKAY LIZARD LIPS! SAY GOODNIGHT!

YIKES

CONCLUDED NEXT ISSUE !

The Transactor Disk

With only 16 characters per filename, many of the programs on Transactor Disks have somewhat deceiving titles. Most are self-explanatory, others have been appended with additional briefings.

Programs with block counts of only 1 or 2 are usually just subroutines for use within other programs. A "dazzler" is our way of describing the more entertaining (as opposed to useful) programs. And a "demo" indicates illustration of a concept as opposed to a demonstration of the cosmetic variety. A 'V1' in these descriptions indicates Version 1 – look for a similar filename on a later disk for an update. 'ML' denotes Machine Language, '.bas' is a BASIC file, and '.pal' or '.src' is a PAL Assembler source code file.

TransBASIC files propagate forward to each new disk. Descriptions of TransBASIC files will appear only on the first disk on which they were offered. However, most TB modules can not possibly be described in brief. Commands within modules are listed in REM statements – complete descriptions of the commands can only be obtained from the magazine. Summaries of all commands can be found in the TransBASIC column. The prefix 'TB:' will be used in this list to show TB command files.

"transactor disk1"

1	**"–vol 4 issue 01–"**	prg	
1	"opt illusion 4.0"	prg	dazzler
23	"unassembler 4.0"	prg	
4	"string thing 4.0"	prg	4.0 string utility
14	"bmbstringthing"	seq	source code
2	"stringthing.bin"	prg	object code at $7e00
7	"chain tracer"	prg	traces disk files
2	"ieee modem drivr"	prg	
2	"keyboard setup"	prg	indexed arrays demo
9	"SPet terminal"	prg	in basic
7	"vic aid.rel"	prg	tiny basic aid
3	"vic modem driver"	prg	
1	**"–vol 4 issue 02–"**	prg	
1	"ftoutsm 4.0"	prg	dazzler
2	"brain bender 4.0"	prg	dazzler
1	"vertical message"	prg	vertical printing demo
1	"vert msg part2"	prg	
2	"screen marker"	prg	cursor positioning
2	"writing a file"	prg	basic code from
2	"reading a file"	prg	an article by
1	"coding comments"	prg	jim butterfield
3	"translator.src"	prg	a translation table
2	"translator.ldr"	prg	utility for basic 4
3	"translator demo"	prg	
12	"sid friend part1"	prg	c64 sid keyboard demo
8	"skiffle band 1"	prg	programmed sid music
7	"skiffle band 2"	prg	
22	"basic aid editor"	prg	extension to basic aid
6	"joystick reader"	prg	
1	**"–vol 4 issue 03–"**	prg	
3	"kaleidoscope 80"	prg	dazzler
4	"disk append 4.0"	prg	append to basic text
7	"string thing 64"	prg	string utility
2	"tapemaker 64"	prg	send disk files to tape
6	"univ disk change"	prg	change device #
3	"screen center"	prg	center text demo
11	"catstrapolator"	prg	catalog info retrieval
11	"catstrapolator64"	prg	of blocks free, ID, etc.
5	"sid friend part2"	prg	
2	"char sets prog1"	prg	move c64 char set
2	"char sets prog2"	prg	from rom to ram
2	"char sets prog3"	prg	
6	"character editor"	prg	for hi-res chars
10	"high res dumper"	prg	to 8023 printer
15	"labeler.src"	prg	for labelling basic
6	"label loader.vic"	prg	to allow goto & gosub
6	"label loader.c64"	prg	to use labels instead
2	"label test prog"	prg	of line numbers.
12	"c64 tiny aid ldr"	prg	c64 tiny basic aid
1	**"–vol 4 issue 04–"**	prg	
2	"1 line squiggle"	prg	dazzler
2	"cathode ray prg1"	prg	dazzler
1	"cathode ray prg2"	prg	dazzler
3	"datadjuster"	prg	for controlling data reads V1
2	"retina wrencher"	prg	dazzler
2	"wordpro lister"	prg	
8	"hard disk backup"	prg	9060/9090 to floppies
10	"superkey 64"	prg	keyword burst keys
5	"redecode 8032"	prg	keyboard interception demo
4	"sid friend part3"	prg	
6	"sound help"	prg	sid sound utility
3	"sound help demo"	prg	
23	"sprite palette"	prg	sprite editor
20	"graphics utility"	prg	hi-res utility
31	"graphic util.src"	prg	
6	"raster irq demo"	prg	c64 raster interrupts
13	"raster irq.src"	prg	
1	**"–vol 4 issue 05–"**	prg	ref. issue - no programs
1	**"–vol 4 issue 06–"**	prg	
8	"incrementation"	prg	dazzler
2	"moneyout"	prg	formatting dollar figures
5	"palindrome"	prg	see dictionary
2	"autoliner 4.0 v1"	prg	auto line# generate
2	"autoliner 64 v1"	prg	for entering progs V1
4	"datadjust update"	prg	datadjuster V2
15	"refield"	prg	extension for The Manager
23	"create"	prg	for use with 'refield'
2	"updating 4.0"	prg	updating programs demo
9	"mid string dream"	prg	mid$ demo
1	"get subroutine 1"	prg	
2	"get subroutine 2"	prg	
3	"get subroutine 3"	prg	
8	"menu type 1"	prg	menu driver demos
5	"menu type 2"	prg	
6	"menu type 3"	prg	
2	"directory type 1"	prg	display disk
2	"directory type 2"	prg	dirs from basic
4	"date subrtn 1"	prg	input valid
3	"date subrtn 2"	prg	date strings
3	"st interrogate"	prg	status word handling
8	"univ disk rtns"	prg	basic disk file readers
6	"sid friend part4"	prg	
38	"sid friend part5"	prg	
8	"function key 64"	prg	define function keys
9	"copier64 generat"	prg	generates next prog
2	"copy file 64"	prg	for single drive copies

71 blocks free.

"transactor disk2"

1	**"-vol 5 issue 01-"**	prg	
2	"the brain"	prg	dazzler
2	"marquis 80"	prg	banner program
3	"marquis 64"	prg	
2	"marquis 40"	prg	
2	"marquis 20"	prg	
2	"the boxer"	prg	dazzler
3	"the plunge"	prg	dazzler
2	"sequins 40/80"	prg	dazzler
2	"sequins 64"	prg	
2	"curtains"	prg	dazzler
2	"graphic print"	prg	graphs weighted by letters
1	"reverse rvs"	prg	alternate rvs on/off
1	"1 line pet emulr"	prg	for most pet programs
3	"on error goto"	prg	error trapper
2	"but seriously"	prg	drum roll, cymbals
2	"zoundz"	prg	sid sound demo
1	"a-maze-ing"	prg	maze generator
5	"waves 64"	prg	sid surf sound
6	"vic 20 sound"	prg	bach for vic 20
22	"pet sound fx"	prg	popular sound effects
14	"sound maestro 64"	prg	sid sound utility
8	"quarter master"	prg	the song
9	"sprite rotate"	prg	
10	"quasimob loader"	prg	get more than 8 sprites
25	"quasimob.src"	prg	
2	"change screen 64"	prg	colour changes
7	"harmonic motion"	prg	plotting routine
6	"qtr sqr plot 80"	prg	quarter square plotter
6	"qtr sqr plot c64"	prg	
7	"qtr sqr vic norm"	prg	
7	"qtr sqr vic expd"	prg	
4	"projectile 4.0"	prg	plotting a projectile path
4	"projectile 64"	prg	
8	"talk clock 4.0"	prg	talking clock for use
9	"talk clock 64"	prg	with votrax sc-01
8	"talk clock vic"	prg	
3	"cartridge sim"	prg	simulate cartridges
5	"generate demo 64"	prg	program generator
2	"gen generate 64"	prg	
1	**"-vol 5 issue 02-"**	prg	
3	"down scroll 64"	prg	
1	"color ftoutsm 64"	prg	dazzler
5	"ftoutsm.ml"	prg	dazzler
1	"ama-zamara-ing"	prg	screen effects
1	"stop disable 64"	prg	disable run/stop restore
2	"autoliner 4.0 v2"	prg	generate line numbers
2	"autoliner 64 v2"	prg	version 2
2	"screen copy vic"	prg	screen to printer
2	"eep eep 4.0"	prg	basic 4.0 irq sound
2	"mirror 80"	prg	text mirroring
2	"mirror 40"	prg	
3	"mirror 64"	prg	
3	"ram scan 80"	prg	ML memory display
4	"ram scan 40"	prg	
3	"ram scan 64"	prg	
3	"crystal"	prg	draw crytaline patterns
2	"un cursor 80"	prg	
2	"un cursor 40"	prg	
3	"un cursor 64"	prg	
3	"un cursor 20"	prg	
1	"pop c64"	prg	clear returns from stack
4	"un token memory"	prg	a basic lister
5	"un token disk"	prg	
12	"merge 4.0"	prg	merge basic text
12	"merge c64"	prg	
39	"basic monitor 64"	prg	a basic MLM
11	"pi program"	prg	calculate pi
3	"rocket64 ml.run"	prg	ML thrust vs. gravity demo
7	"rocket64 bas.run"	prg	basic version
2	"rocket.sprt"	prg	
2	"rocket.obj"	prg	
8	"rocket listing 2"	prg	
10	"rocket listing 3"	prg	
8	"rocket listing 4"	prg	
3	"rocket listing 5"	prg	
6	"string insert 64"	prg	insert strings into strings
16	"cia timer demo"	prg	
7	"tod clock 64"	prg	time of day clock demo
5	"joycursor 64"	prg	control cursor with joystick
2	"sx64 emulate pt1"	prg	
1	"sx64 emulate pt2"	prg	
1	**"-vol 5 issue 03-"**	prg	
1	"line doo daa"	prg	dazzler
2	"colour test 64"	prg	contrast adjustment
1	"bytefinder ram"	prg	find byte values
1	"bytefinder disk"	prg	
3	"un-dim 4.0/2.0"	prg	clear arrays
4	"un-dim vic/64"	prg	
2	"errorouter 64"	prg	trap errors
4	"line hider"	prg	hide entire lines
3	"ghost liner"	prg	hide lines but not line#
5	"list decorator"	prg	control over LIST
3	"etchasketch"	prg	
2	"default colours"	prg	after run/stop restore
2	"restore x 64"	prg	control DATA read pointer
2	"led demo"	prg	user port demo
3	"led knight rider"	prg	
4	"led roulet wheel"	prg	
15	"quadra 64 loader"	prg	partition text space
1	"quadra 64 init"	prg	
23	"quadra 64.src"	prg	
1	"basmon part2"	prg	ML monitor in basic
9	"picprint 64"	prg	hi-res to printer V1
17	"picprint 64.src"	prg	
4	"basic compare"	prg	compare basic prg files
8	"scramble.bas"	prg	basic encryption technique
9	"scramble.ml"	prg	
7	"scramble64.ml"	prg	
4	"password prot 1"	prg	password encryption
4	"password prot 2"	prg	file protection
10	"disk defender"	prg	disk protection demo
10	"disk defend 8050"	prg	
5	"lockdisk 4.0"	prg	force run after load
4	"lockdisk 64"	prg	
15	"drive protect"	prg	disk utility
7	"disk view/change"	prg	examine disk contents
16	"diskmod 4.0"	prg	

24 blocks free.

"transactor disk3"

1	**" + business & ed. + "**	prg	
1	"quick beep 64"	prg	
1	"colour bar 64"	prg	compare colours
1	"dazzle attack4.0"	prg	dazzler
1	"aquarius 80"	prg	dazzler
3	"int scan 64.src"	prg	keyboard scanning
3	"int scan 4.0.src"	prg	
3	"file ripper 4.0"	prg	fast seq reader
3	"file ripper 64"	prg	
1	"file loader"	prg	successive loading demo
2	"ascii/cbm"	prg	converter
1	"magic number"	prg	arithmetricks
2	"safe val subrtn"	prg	VAL(substitute
3	"prime number gen"	prg	
1	"short prime gen"	prg	
4	"expeval 64 ldr"	prg	expression evaluator
4	"expeval plot"	prg	
7	"expeval 64.pal"	prg	

```
5     "compound intrest"      prg
5     "get string loadr"      prg   get subroutine
14    "getsrc.pal"            prg
25    "sort 64.pal"           prg   cascading sort routine
11    "sort 64 create"        prg
3     "sort 64"               prg
5     "sort 64 demo1"         prg
5     "sort pet demo1"        prg
3     "sort 64 demo2"         prg
3     "sort pet demo2"        prg
11    "sort pet create"       prg
3     "sort pet"              prg
30    "philemaster pet"       prg   simple database
31    "philemaster 64"        prg
28    "philemas pet cas"      prg
29    "philemas 64 cass"      prg
15    "home budget"           prg
39    "basic monitor 64"      prg
3     "count wpm"             prg   count words per minute
13    "speller"               prg   spelling drill
17    "autoswap 64.ldr"       prg   multitasking utility
33    "autoswap 64.pal"       prg
291 blocks free.
```

"transactor disk4"

```
1     " + hardwar/periph + "  prg
8     "aid2"                  prg   tiny basic aid for basic 2
8     "aid4"                  prg   for basic 4.0
7     "vic aid.rel"           prg   for the vic 20
8     "c64 tiny aid ldr"      prg   for the c64
10    "supermon2.rel"         prg   M.L. monitor prog
9     "supermon4.rel"         prg   for basic 4.0 machines
10    "super vicmon2"         prg   for vic20
10    "supermon64.v1"         prg   for c64
10    "copy-all"              prg   for unit to unit disk copying
10    "copy-all64"            prg   for multiple 1541s
2     "copy file 64"          prg   single 1541 copier
23    "unassembler 4.0"       prg   make source from object code
1     "----------------"      prg
2     "memory save 64"        prg   save memory ranges
2     "control keys 64"       prg   detect special keys
2     "inst colr chng64"      prg   change screen colours
3     "drowning in garb"      prg   dazzler
3     "single disk copy"      prg   basic file copier
3     "single copy 64"        prg   c64 version of above
3     "clear/plot bas64"      prg   point plot/hi-res clear routine
3     "hex table"             prg   prints dec/hex table
5     "large chars 64"        prg   char rom demo
6     "reset protector"       prg   emulate cartridges
3     "transbasic instr"      prg   brief transbasic instructions
15    "tb/kernel"             prg   transbasic kernel
10    "add"                   prg   TB: add source code
23    "tb/add.src"            prg   kernel source + add source
4     "tb/add.obj"            prg   object code for above
5     "screen things"         prg   TB: border, background, etc.
1     "hard cornr prg1"       prg   read data reg bits
2     "hard cornr prg2"       prg   read user port switches
2     "hard cornr prg3"       prg   read 4 x 4 keyboard matrix
6     "hard cornr prg4"       prg   scan c64 keyboard hardware
3     "keyboard click"        prg   keyboard audio feedback
5     "projector ctrl"        prg   slide projector hardware
4     "linked lists 1"        prg   sort without sorting
6     "linked lists 2"        prg
2     "linked lists 3"        prg
8     "disk datafier 4"       prg   a faster basic loader
8     "disk datafier 64"      prg   for ML data
8     "disk datafier 20"      prg
399 blocks free.
```

"transactor disk5"

```
1     "aids & utilities"      prg
8     "aid4"                  prg
7     "vic aid.rel"           prg
8     "c64 tiny aid ldr"      prg
10    "supermon2.rel"         prg
9     "supermon4.rel"         prg
10    "super vicmon2"         prg
10    "supermon64.v1"         prg
10    "copy-all"              prg
10    "copy-all64"            prg
2     "copy file 64"          prg
3     "transbasic instr"      prg
4     "tb/add.obj"            prg
15    "tb/kernel"             prg
23    "tb/add.src"            prg
10    "add"                   prg
5     "screen things"         prg
4     "verifizer.vic/64"      prg   program entry checker
4     "verifizer.pet"         prg
1     "----------------"      prg
2     "wordprodump"           prg
2     "regain"                prg   un-new utility
2     "border flasher"        prg   warm-start demo
3     "double directory"      prg   double width disk dirs
2     "c64 disk status"       prg   error channel reader
1     "cbm scrn dump 80"      prg
1     "cbm scrn dump 40"      prg
3     "phone speller"         prg   phone# letter combinations
5     "keyword pet.bas"       prg   keyword burst keys
5     "keyword c64.bas"       prg
5     "keyword vic.bas"       prg
4     "irq display.pal"       prg   irq driven text display
3     "line clear.pal"        prg   clear all but top 3 lines
1     "--- articles ---"      usr
7     "verigen c64"           prg   generate verifized files
4     "doke & deek"           prg   TB: double poke/peek
3     "bit twiddlers"         prg   TB: set, clear, flip
4     "check & await"         prg   TB: input interception commands
3     "keywords"              prg   TB: show keywords present
18    "error wedge.bas"       prg   adds commands (use '@' as prefix)
41    "error wedge.pal"       prg
45    "keywiz 64"             prg   keyboard driver
33    "linked lists"          prg
52    "hi-res listing 1"      prg   generates file "hires"
5     "listing 2"             prg   hires pie graphs
5     "listing 3"             prg   hires bar charts
10    "listing 4"             prg   hires expression plotter
8     "vicparms"              prg   vic II chip parameter calc.
13    "bigprint"              prg   hi-res screen to printer
3     "sprite ed1"            prg   two short sprite
6     "sprite ed2"            prg   editors
15    "list scroll"           prg   using crsr keys
10    "stp.bas"               prg   seq to prg - execute from
8     "stp.pal"               prg   a seq file (like batching)
5     "quote killer"          prg   quote mode utility
7     "gap fill"              prg   remove dir gaps left by Scratch
47    "print ml.c64"          prg   ML loader technique
10    "print ml.vic1"         prg
10    "print ml.vic2"         prg
8     "super cat"             prg   dir info extractor
1     "numeric keypad"        prg   utility for the c64
31    "disk/exmon @8000"      prg   disk extramon for c64
31    "disk/exmon @1000"      prg   adds disk plus MLM commands
4     "drive peeker"          prg   inner disk utility
11    "file compare.pet"      prg   compare two files
11    "file compare.c64"      prg   byte by byte (in ML)
0 blocks free.
```

"transactor disk6"

1	**"more aids + utils"**	prg	
8	"aid4"	prg	
7	"vic aid.rel"	prg	
8	"c64 tiny aid ldr"	prg	
10	"supermon2.rel"	prg	
9	"supermon4.rel"	prg	
10	"super vicmon2"	prg	
10	"supermon64.v1"	prg	
10	"copy-all"	prg	
10	"copy-all64"	prg	
2	"copy file 64"	prg	
3	"transbasic instr"	prg	
4	"tb/add.obj"	prg	
15	"tb/kernel"	prg	
23	"tb/add.src"	prg	
10	"add"	prg	
5	"screen things"	prg	
4	"cursor position"	prg	TB: set or check crsr pos.
7	"set sprites"	prg	TB: sprite commands
5	"within"	prg	TB: test number for 'within range'
4	"read sprites"	prg	TB: sprite monitoring
4	"verifizer.vic/64"	prg	
4	"verifizer.pet"	prg	
10	"stp loader"	prg	seq to prg (batch) utility
1	"stp sys49152"	prg	
1	"stp sys828"	prg	
1	"----------"	prg	
3	"racer pet"	prg	cheap video game
3	"racer 64"	prg	
3	"racer vic"	prg	
3	"racer +4"	prg	
2	"tickertape 64"	prg	with sound effects
2	"dec to base b"	prg	convert to base b
2	"screen save vic"	prg	save screen to disk
3	"save@ exposed!!!"	prg	@ replace bug demo
13	"dos exec filer"	prg	execute programs in disk memory
2	"create device 9"	prg	device# changer and head knock
2	"create anti-nok"	prg	eliminator for use with above
34	"alpha dir.bas"	prg	alphabetize disk directories
26	"alpha dir.pal"	prg	
3	"auto-default.bas"	prg	change reset default values
4	"auto-def.create"	prg	
7	"auto-default.pal"	prg	
6	"file pursuit"	prg	trace and size
8	"supernumber.bas"	prg	indestructible variables
2	"supernum array"	prg	
11	"supernumber.pal"	prg	
1	"supnum sys49152"	prg	
1	"varptr"	prg	returns address of variables
4	"func keys.bas"	prg	screen editor extensions
4	"func keys.pal"	prg	
10	"bootmaker 64"	prg	makes boot for common loads
15	"datapoke aid"	prg	data entry utility
12	"load & run.pal"	prg	load and run ML programs
4	"l & r create.c64"	prg	automatically without
4	"l & r create.pet"	prg	necessarily knowing
4	"l & r create.vic"	prg	start addresses
10	"a/d pet.basic"	prg	analog to digital input
8	"a/d pet.pal"	prg	utility with hardware
6	"chopper"	prg	PAL file line splitter
13	"chopper.pal"	prg	
16	"labelgun"	prg	PAL label re-definition
31	"labelgun.pal"	prg	
44	"r65c02 assembler"	prg	for the R65C02 CPU
9	"fig 1 new ops"	seq	SEQ files for use with
1	"fig 3a writechrs"	seq	above program
4	"fig 3b writechrs"	seq	
2	"fig 4 linker eg."	seq	

135 blocks free.

"transactor disk7"

1	"comm + networkin"	seq	
8	"aid4"	prg	
7	"vic aid.rel"	prg	
8	"c64 tiny aid ldr"	prg	
10	"supermon2.rel"	prg	
9	"supermon4.rel"	prg	
10	"super vicmon2"	prg	
10	"supermon64.v1"	prg	
10	"copy-all"	prg	
10	"copy-all64"	prg	
2	"copy file 64"	prg	
3	"transbasic instr"	prg	
4	"tb/add.obj"	prg	
15	"tb/kernel"	prg	
23	"tb/add.src"	prg	
10	"add"	prg	
5	"screen things"	prg	
4	"cursor position"	prg	
7	"set sprites"	prg	
5	"within"	prg	
4	"read sprites"	prg	
5	"strip & clean"	prg	TB: string purging
20	"scrolls"	prg	TB: scroll screen windows
4	"verifizer.vic/64"	prg	
4	"verifizer.pet"	prg	
10	"stp loader"	prg	
1	"stp sys49152"	prg	
1	"stp sys828"	prg	
1	"----------"	prg	
4	"flash"	prg	flash characters for c64
2	"boxspiral +4"	prg	plus4 box demo
4	"hires text"	prg	copy ROM chars to hi-res screen
1	"c64 fastkey"	prg	GET speed increaser
3	"banner"	prg	simple marquis program
1	"screen sizzle"	prg	dazzler
5	"b to xx32.bas"	prg	convert B machine files
3	"1541 align"	prg	1541 head alignment
7	"tdd termprog"	prg	TDD communications terminal
8	"remote.bas"	prg	c64 remote control utility
14	"remote.pal"	prg	
13	"c64 bbs link"	prg	bbs numbers database
3	"sort64"	prg	load this (,8,1) for use with above
16	"tele-tone 64"	prg	touch tone generator
5	"1541 dual drive"	prg	simulation using 2 1541s
11	"vector manager"	prg	cascade irq routines
2	"++++++++++++++"	prg	
8	"extra extra"	prg	intstructions for following prgs
15	"terminal.r12"	prg	pet/cbm terminal prog
7	"term.r12"	prg	
4	"intelcom3"	prg	
4	"intelcom4"	prg	
1	"spet term"	prg	uses superpet acia
17	"term6s.g"	prg	
7	"terminal/vic.c1"	prg	vic 20 rs232 terminal
7	"term/vic.c1"	prg	
3	"firstdial3 boot"	prg	c64 with autodial
4	"firstdial3"	prg	
6	"miteydialer3 bt"	prg	c64 with mitey mo modem
3	"miteydialer3"	prg	
1	"firstterm3 boot"	prg	without autodial
54	"firstterm3"	prg	
3	"firstdial3 print"	prg	
132	"firstdial3 doc"	seq	documentation
3	"firstdial3 fkeys"	seq	fkey definitions
1	"higgyboot +4"	prg	plus 4 terminal
41	"higgyterm +4"	prg	

28 blocks free.

"transactor disk8"

```
1     "the languages"        seq
8     "aid4"                 prg
7     "vic aid.rel"          prg
8     "c64 tiny aid ldr"     prg
10    "supermon2.rel"        prg
9     "supermon4.rel"        prg
10    "super vicmon2"        prg
10    "supermon64.v1"        prg
10    "copy-all"             prg
10    "copy-all64"           prg
2     "copy file 64"         prg
3     "transbasic instr"     prg
4     "tb/add.obj"           prg
15    "tb/kernel"            prg
23    "tb/add.src"           prg
10    "add"                  prg
5     "screen things"        prg
4     "cursor position"      prg
7     "set sprites"          prg
5     "within"               prg
4     "read sprites"         prg
5     "strip & clean"        prg
20    "scrolls"              prg
10    "labels"               prg   TB: basic code labelling
5     "token & var"          prg   TB: token$(, var(
8     "instring"             prg   TB: string compare
7     "place"                prg   TB: scan strings
7     "arcfunctions"         prg   TB: arcsine, arccos
3     "printat"              prg   TB: print@ col,row
18    "sound things"         prg   TB: sid control
4     "verifizer.vic/64"     prg
4     "verifizer.pet"        prg
10    "stp loader"           prg
1     "stp sys49152"         prg
1     "stp sys828"           prg
2     "RUN ME!"              prg   prints subscription form
3     "RUN ME TEXT"          seq
12    "RUN ME FORM"          seq
1     "----------------"     prg
1     "1541 spin1"           prg   spin 1541 drive motor
2     "1541 spin2"           prg   uses SHIFT for on/off
1     "blks free-1541"       prg   reports 1541 blocks free
2     "save-protect"         prg   1541 BAM adjuster
1     "scratch&save.bas"     prg   SAVE@ alternative
4     "scratch&save.pal"     prg
4     "menu prg"             prg   menu driver
2     "list freeze"          prg
2     "waving spokes"        prg   plus4 graphics demo
2     "kaleidoscope"         prg   dazzler
3     "asc to bin.pal"       prg   in ML
2     "bin to asc.pal"       prg
1     "lett'er fly!"         prg   GET tips
3     "18-0 un-screw"        prg   disk utility
4     "star 0.14"            seq   for COMAL 0.14
4     "star 2.00"            seq   for cartridge COMAL 2.00
4     "profiler.pal"         prg   analyze time consumption
2     "profiler.bas"         prg   of basic programs
3     "profiler.ldr"         prg
4     "hi-res text demo"     prg   print scaled hi-res text
12    "hi-res text ldr"      prg
23    "hi-res text src"      prg
2     "++++++++++++++f"      prg
5     "bootcomal"            prg   boot for COMAL 0.14
131   "comal80.can"          prg   notice the block count
5     "comalerrors"          seq
10    "generror.e.l"         seq
6     "hi"                   prg
6     "see'information"      prg
6     "see'instructions"     prg
21    "information83nov"     seq
42    "instructions0.14"     seq
20    "logo'book'sample"     prg
37 blocks free.
```

"transactor disk9"

```
1     "impl. sciences"       seq
8     "aid4"                 prg
7     "vic aid.rel"          prg
8     "c64 tiny aid ldr"     prg
10    "supermon2.rel"        prg
9     "supermon4.rel"        prg
10    "super vicmon2"        prg
10    "supermon64.v1"        prg
10    "copy-all"             prg
10    "copy-all64"           prg
2     "copy file 64"         prg
17    "yellow pages 1.2"     prg   c64 disk utility
3     "transbasic instr"     prg
4     "tb/add.obj"           prg
15    "tb/kernel"            prg
23    "tb/add.src"           prg
10    "add"                  prg
32    "use"                  prg   TB: like add, only faster
5     "screen things"        prg
4     "cursor position"      prg
7     "set sprites"          prg
5     "within"               prg
4     "read sprites"         prg
5     "strip & clean"        prg
20    "scrolls"              prg
10    "labels"               prg
5     "token & var"          prg
8     "instring"             prg
7     "place"                prg
7     "arcfunctions"         prg
3     "printat"              prg
18    "sound things"         prg
12    "move & fill"          prg   TB: memory transfers
11    "dos support"          prg   TB: dos command wedge
5     "line calc"            prg   TB: for gotos & gosubs
3     "beep"                 prg   TB: SID beep
3     "stripper"             prg   removes PAL comments
4     "verifizer.vic/64"     prg
4     "verifizer.pet"        prg
10    "stp loader"           prg
1     "stp sys49152"         prg
1     "stp sys828"           prg
2     "RUN ME!"              prg
3     "RUN ME TEXT"          seq
12    "RUN ME FORM"          seq
1     "----------------"     prg
6     "quake"                prg   dazzler
5     "errcat 64/20"         prg   catalog routine
2     "rt justify pet"       prg   right justify demo
2     "drive speed"          prg   alter drive parameters
2     "basic stp"            prg   seq to prg in basic
3     "gauss elim"           prg   gaussian elimination routine
4     "lottery"              prg   lottery numbers generator
1     "swords of doom"       prg   dazzler
1     "sum of squares 1"     prg   summing techniques to
1     "sum of squares 2"     prg   help overcome problems
1     "sum of squares 3"     prg   with binary inaccuracies
11    "projector"            prg   plot graphs with 3 dimensions
9     "hires"                prg   for use with projector
13    "bigprint"             prg   for use with projector
6     "timer64.bas"          prg   microsecond timer
4     "timer64.pal"          prg
3     "projectile pet"       prg   bounce plotter
4     "projectile 64"        prg   bouncing sprite plotter
12    "comp1.pal"            prg   data compressor programs
20    "comp2.pal"            prg
2     "comp1.obj",8,8:       prg
2     "comp2.obj",8,8:       prg
5     "koala split"          prg   for use with compressor, splits
6     "anim split"           prg   koala/animation station pictures
2     "vars-indestruct"      prg   edit without losing variables
41    "unassembler"          prg   make source code from object
10    "super sound"          prg   SID sound utility
116 blocks free.
```

News BRK

Submitting NEWS BRK Press Releases

If you have a press release which you would like to submit for the NEWS BRK column, make sure that the computer or device for which the product is intended is prominently noted. We receive hundreds of press releases for each issue, and ones whose intended readership is not clear must unfortunately go straight to the trash bin. It should also be mentioned here that we only print product releases which are in some way Applicable to Commodore equipment.

Transactor News

Transactor Subscription Prices...

Are remaining at the old price of only $15.00 per year, even with the new Newsstand price of $3.50/copy. Now a subscription to The Transactor saves you even more - 29% over the newsstand price! Now is the time to finally get around to sending in that subscription card you've been holding on to.

Viewtron Starter Kit

The Viewtron Starter Kit will be available in Canada from Transactor Publishing. The price is about the same after the exchange rate, but experience has shown that ordering goods from the U.S. into Canada can take longer than migrating tortoises. Also, phone orders from Canada mean a long-distance call to Miami since toll-free 1-800 numbers don't cross international borders. And speaking of borders, well. . . we all know what happens to packages that even look dutyable.

The Starter Kit is a nifty package, too. The software is terrific. It comes with files containing several phone numbers for the major networks and a program that displays those within your area code. Once your ID and Password are recorded, signing on is simply a matter of loading the Viewtron communications program and hitting one key. You'll like the manual – 46 pages of handy reference and instructions for everything from using Viewtron CB to dumping to printer, disk, etc. For more on Viewtron, see the article in this issue.

So if you live in the U.S., call Viewtron's toll free line (see next item). But if you're ordering the kit for delivery within Canada, you can use our postage paid order form and let us arrange for the first half of it's journey.

Viewtron Now Available To Commodore Owners

Viewdata Corporation of America is now offering its Viewtron videotex service to Commodore personal computer owners in most cities throughout Canada and the U.S.

Viewtron subscribers can save time gathering valuable information. They can get up-to-the-minute news, weather forecasts, continuous sports scores, current stock prices, airline schedules and fares, consumer reports and movie and book reviews.

Viewtron subscribers can also send electronic messages, and, through a growing list of banks, pay bills and get account balances. They even have access to an up-to-date encyclopedia.

In addition to the basic Viewtron service, there are enhanced services for Commodore subscribers. Some of these include:

- Commodore software reviews and ratings
- Software and hardware advice from experts and other subscribers
- Discounts on top-selling Commodore software
- Discounts on computer hardware
- Commodore special interest clubs

Viewtron is the first complete on-line service that runs in colour on Commodore 64s. To get Viewtron, Commodore owners will need to purchase the Viewtron Software Starter Kit for $9.95 (US). The kit includes a diskette with communications software, one free hour of service, an ID and password, and a user manual.

Subscribers will pay only for their use of the service. No monthly minimums will be charged. Rates are: nine cents a minute, weekday nights (after 6 p.m.) and weekends; and 22 cents a minute weekdays. And, unlike other services, there is no extra charge for subscribers using 1200-baud modems. (Prices may vary in some cities.)

Viewtron also runs on the Commodore 128, and will run on the Amiga in 1986. For more information, call the Viewdata Corporation at 1-800-272-5400

More Viewtron News

Commodity traders almost anywhere in the U.S. can now keep up with the volatile and complex futures market with VIEWTRON®, the electronic information service offered by Viewdata Corporation of America, Inc.

VCA offers trading prices of nearly 100 commodities, ranging from aluminum to wheat, updated every 10 minutes. Prices are gathered from 14 exchanges by Commodity News Services, Leawood, Kansas. Both companies are owned by Knight-Ridder Newspapers.

When a subscriber requests a price quotation, all of the contracts in a given commodity are listed, with their opening, high, low and last available prices, along with the change from the previous settlement price.

Contact: John L. McCarthy,
V.P. Business Information Services
(305) 674-3499

West Coast Commodore Show II

The West Coast Commodore Association proudly announces "THE COMMODORE SHOW II" to be held on Saturday, February 8th and Sunday, February 9th, 1986 from 10:00 am to 6:00 pm at the Cathedral Hill Hotel in San Francisco.

This Commodore-specific trade show will feature the latest in software and hardware for the vast Commodore users market. THE COMMODORE SHOW II will cover the newest Commodore machines; the Amiga and the C-128 as well as the 64 and Plus 4.

The show will also feature noted Commodore experts speaking on graphics, telecommunications, music, business applications and other subjects of interest to Commodore users.

The first COMMODORE SHOW held in February of 1985 drew 5200 attendees and next year's show promises to be bigger and better.

For information on booth space and advance ticket sales, interested users groups and hardware/software vendors should contact:

West Coast Commodore Association
P.O. Box 210638
San Francisco, CA 94121
(415) 982-1040

Commodore 128 On Dealer Shelves

Toronto, Ont. — Commodore Business Machine Limited announced that the Commodore 128 Personal Computer is in stores across Canada effective October 1. Over 1,000 retail outlets including mass merchandisers, department stores and computer dealers, will carry the new C128.

The Commodore Ham's Companion

Springfield, Illinois — QSKY Publishing introduces a new book designed to fill the need for information on using Commodore computers in the amateur radio "ham shack". "The Commodore Ham's Companion", written by Jim Grubbs, K9EI, helps show the way toward effective use of Commodore machines for this purpose.

The book's fourteen chapters address many subjects, including:

- Selecting a Commodore machine for the ham shack, or upgrading your present system.
- The basics behind programming for data including RTTY, Morse, AMTOR and Packet.
- The ins and outs of information management, like log, dupe and awards programs, are explained.
- Why Commodore machines are the easiest to interface
- "Telehamming" - connecting to amateur radio information by telephone line.
- Where to find specialized software for slow scan television, satellite tracking and many other exotic applications.
- How to obtain a dramatic increase in speed without learning machine language.

Additionally, a set of valuable appendices include over 80 sources for software and hardware for amateur radio applications. A bibliography with over 60 magazine articles and columns on Commodore computers in the radio shack is also included. A glossary and other resource list rounds out the book.

Retail price for the 160-page paperback is $15.95 U.S. plus $2.50 for shipping and handling. For more information or to order, contact:

QSKY Publishing
P.O. Box 3042
Springfield, IL
USA 62708

Starting Your Computer Services Business

J.V. Technologies, Inc. announces the release of the new book *Starting Your Computer Services Business* by Dr. John Desiderio for those interested in using their computer to earn extra income. This comprehensive manual discusses the various phases and stages of starting a business, examining pitfalls and reviewing the proper steps to successfully organizing a new business.

Various business formats, such as, sole proprietorships, partnerships and corporations, are examined in detail with a clear discussion of the advantages and disadvantages of each. The book not only reviews the typical computer services of consulting and word processing, but extends beyond these to discuss how activities such as teaching, telecommunications, article and book writing, software development, etc. can also contribute to starting and maintaining a flourishing computer services business. Persons interested in working either part- or full-time, from their home or in a small office, will find this book to be an invaluable resource.

Also included is a separate chapter on advertising and a complete section of reproducible forms for keeping track of your business activities, such as advertisements, orders, etc. The introductory cost of the publication is $9.95 (US) and a 30 day money-back guarantee is also offered. Contact:

J.V. Technologies, Inc.
P.O. Box 563
Ludington, MI 49431
(616) 843-9512

1986 Printer Directory and Specification Guide

Gorham International is initiating the "1986 Printing Directory and Specification Guidebook Series". The series consists of four volumes:

TITLE	Scheduled Publication Date
Thermal Printing	Oct. 31, 1985
Toner Based Printing	Nov. 30, 1985
Colour Hard Copy Printer	Dec. 31, 1985
Ink Jet Printing	Jan. 31, 1986

Primary features of this four volume series include:

- Specifications of each printer system presented in a standard, easy to use format from Gorham's computerized database
- Inclusion of actual manufacturer's product literature and print samples in all possible cases.
- Gorham's computerized database provides a detailed summary and overview section in each publication. This enables useful categorizations of competitive products and grouping of products by selected specifications, applications, etc.
- Hardbound reference volumes designed to aid current and potential users in their identification, evaluation and selection of printer products. These limited edition publications of 500 copies each provide a unique presentation format by which product manufacturers can provide practical information, literature and samples to marketplace.

Vicki Woodbrey, who manages Gorham's database, states that "all manufacturers and suppliers of hardware, consumables, components, services, etc. are encouraged to contact her to assure their product information has been incorporated into the Gorham database."

Each of the four volumes are available individually at a price of $250.00 U.S. including shipping for prepaid orders (additional $25.00 for overseas airmail). For additional information or to verify product inclusion, please contact:

Alvin G. Keene or Vicki Woodbrey
GORHAM INTERNATIONAL INC.
P.O. Box 8
Gorham, ME 04038

Scenery Disks Now Available for Flight Simulator II and Jet

SubLOGIC is pleased to announce the release of six different Scenery Disks for the Commodore 64 and IBM PC. These Scenery Disks expand the potential flying environment of SubLOGIC flight simulation products including Flight Simulator II, Jet, and the (IBM) Microsoft Flight Simulator.

Six Scenery Disks covering the entire western half of the Continental United States are now available. Each disk covers a geographical region of the country, and includes the major airports, radio-nav aids, cities, highways, rivers, and lakes located in that region. Enough detail is included on each disk for either visual or instrument cross-country navigation.

Each Scenery Disk package comes complete with appropriate sectional charts plus full airport and nav-aid directories. Individual Scenery Disk packages are available for $19.95 (US) each. The Western U.S. six-disk set, packaged in a vinyl three-ring notebook with dividers, may be purchased for $99.95 (US).

To order, specify computer system and which disks you want, add $2.00 ($5.00 for the six-disk set) for postage, and specify UPS or first class mail delivery.

SubLOGIC Corporation
713 Edgebrook Drive
Champaign, IL 61820
(217) 359-8482
Order Line: 1-800-637-4983

ZIPP-CODE-48 Development System For C-64

Now you can write code on the Commodore 64/128 for smart peripherals, robotics and other applications using the 8048/8748 family of microcontrollers.

The ZIPP-CODE-48 Cross Assembler is a powerful, symbolic assembler for the 8048 microprocessor family. In addition to the basic instruction set used with the 8048/8748 NMOS microprocessors, the ZIPP-CODE-48 System correctly cross-assembles, disassembles, and simulates four other related instruction sets. (8021, 8022, 80C48/49/50.)

Additional features of the assembler are: a built-in simulator for debugging; works with standard BASIC-format source files; excellent error-detection; works with tape or disk, with or without printer.

Extra utilities included with the package are a print utility with with alphabetical cross-reference symbol table; a line disassembler; a machine-code save utility; and a full-featured machine code monitor program.

ZIPP-CODE-48 is available for $49.95 (US). Order from:

Hughes Associates Software
45341 Harmony Lane
Belleville, MI 48111
(313) 699-1931

Automated Telecommunications Package For The 64 and 128

Progressive Peripherals & Software, Inc. of Denver, Co. has announced the introduction of BOBSTERM PRO, a uniquely powerful telecommunication software program for the Commodore 64 and 128 personal computers. BOBSTERM PRO is unique because it allows complete user control over every aspect of telecommunications.

Every feature of BOBSTERM PRO can be automated through the use of macro programming. Log-on, password entries, auto-start, auto-answer, auto-dial, and transmission of files are a few of the many operations that can be reduced to a single key stroke. Linked together, these macro commands make continuous BBS maintenance simpler and a great deal faster. Complete screen editing, formatting, screen colours and status line information are available to the user. Seven custom character sets are built in for hard copies, with space reserved for three user-defined fonts.

BOBSTERM PRO is compatible with nine popular modems and can be easily adapted to many more. Data transfer can be accomplished through the use of straight ASCII, straight binary, sequential line with prompt wait, XON/XOFF, Punter protocol, XMODEM protocol, or entire disk (C64 to C64). With the special FILL feature, the normal 28.5 K memory can be expanded to handle 94 K files. BOBSTERM PRO is also compatible with all COmmodore and second party computer hardware. Contact:

Progressive Peripherals & Software, Inc.
464 Kalamath Street
Denver, CO 80204
(303) 825-4144

More 64 Software From Progressive

Progressive Peripherals & Software, North American agent for Precision Software of Surrey, England, is pleased to announce SUPERBASE STARTER, a user friendly software database for the Commodore 64 and 128 personal computers.

SUPERBASE STARTER is an electronic filing cabinet to store, retrieve, update, display, and print information in a multitude of ways. SUPERBASE STARTER is a beginning version of the bestselling SUPERBASE. The program runs with application starter packs, making it ideal for non-technical users. The package comes with a manual written with this user in mind. Easy to understand menus of commands and built-in Help Screens are designed to ease the user into the program with a minimum of stress. An audio-learning cassette is also available, upon registration, as an excellent aid to learning SUPERBASE STARTER.

Another addition to the growing line of "SUPER" software programs is SUPERTYPE for the CV-64 and 128. SUPERTYPE is a complete educational tool, addressing the developmental needs of the information age. SUPERTYPE builds touch typing skills in 19 tiered lessons, each leading to the next. Colour tabs are provided to delineate each finger's relationship to a group of keys on the keyboard. A built-in metronome encourages proper rhythm to increase speeds.

SUPERTYPE provides accurate assessment of the student's progress through 'Results Screens' at the end of each session. Times are calculated in sentences typed, errors during exercises, and words per minute corrected and uncorrected. SUPERTYPE then points out which fingers need to be practised and which fingers are making the most mistakes. The steno-style SUPERTYPE manual stands alone, so the student can progress easily through the lessons without hunting for instructions.

Progressive Distributes Commodore's 8023P Printers

Progressive Peripherals & Software, Inc. has become a major distributor for Commodore's 8023P Printer. After successfully opening the market for Commodore's SFD 1001 disk drive, Progressive has decided to distribute the 8023P Printer. In the Commodore microcomputer industry, the 8023P Printer is best known for its high speed and 15 1/2 inch wide carriage. The printer has both business applications and home use advantages. The 8023P Printer is ideal for business use, as it features these options: condensed print, Commodore graphics, wide carriage for printing out large spread sheets, and 150 CPS high speed. The advantages for home use of the 8023P Printer are a near letter-quality mode, longevity, and it is twice as sturdy as the average printer. The 8023P Printer is fully compatible with word processing, database, and other business and personal software. The printer will retail for $299.00 (US).

Progressive Releases E-Link

Progressive Peripherals & Software, Inc. is shipping their newly released Commodore serial to IEEE interface. The E-Link is designed for compatibility with Commodore IEEE peripherals and is totally transparent to the Commodore 64. According to Kris Halverson, Product Manager, "There is a strong demand for an interface that gives the consumer access to the many high-powered Commodore peripherals on the market. The customer will need only one E-Link regardless of the number of IEEE peripherals in use."

Halverson used computer aided design to ensure the rugged reliability of E-Link. E-Link has the following features: uses no internal C-64 memory; independent power supply; and microprocessor controlled. The response to E-Link by Commodore dealers has been strong because E-Link provides needed accessibility to the many available Commodore disk drives and printers. The interface will retail for $99.95 (US). Contact:

Progressive Peripherals & Software, Inc.
2186 South Holly
Denver, Colorado 80222
(303) 759-5713

Low Cost Temperature Monitoring For The Commodore 64

Applied Technologies, Inc. announces a breakthrough in low cost data logging and temperature monitoring with Commodore computers.

Features include display of 8 or 16 temperature channels, temperature range of -15 degrees to +180 degrees Fahrenheit at approximately 1 degree resolution, electronic interface plugs directly into the joystick port, inexpensive weather-protected sensors, and menu-driven software included.

The 8-channel system starts at $89.95 (US). For more information, contact:

Applied Technologies, Inc.
Computer Products Division
Lyndon Way, Kittery, Maine 03904

Communications Chips Seen Rising in Sales As Semiconductor Industry Continues to Slow

Norwalk, CT — Very few people still believe that 1985 will be a good year for the semiconductor industry. In fact, some estimates say the market will be down close to 20 percent this year alone. But integrated circuits for communications equipment will see a 30 percent average growth rate for the rest of this decade, according to a just-published 157-page research report from International Resource Development Inc., a Norwalk, CT market research and consulting firm.

The report, entitled *Telecommunications Integrated Circuits* (#659), covers over fifty major players in the communications IC marketplace, and predicts that even when growth resumes in the semiconductor market as a whole, telecommunications and data communications integrated circuits will continue to outpace the general chip market.

Further details of the $1,650.00 report, including a free table of contents and a description of the topics covered, are available from:

International Resource Development Inc.
6 Prowitt Street
Norwalk, CT 06855
(203) 866-7800; Telex 64 3452

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Issue#	Theme	Copy Due	Printed	Release Date
1	More Aids & Utilities	Feb 1	Mar 22	April 1/85
2	Communications & Networking	Apr 1	May 24	June 1
3	Languages	Jun 1	Jul 26	August 1
4	Implementing The Sciences	Aug 1	Sep 20	October 1
5	Hardware & Software Interfacing	Oct 1	Nov 22	December 1
6	Real Life Applications	Dec 1	Jan 24	February 1/86

Volume 7 Editorial Schedule

1	ROM Routines / Kernel Routines	Feb 1	Mar 21	April 1
2	Games From The Inside Out	Apr 1	May 23	June 1
3	Programming The Chips	Jun 1	Jul 25	August 1
4	Gadgets and Gizmos	Aug 1	Sep 26	October 1
5	Simulations and Modelling	Oct 1	Nov 21	December 1
6	Programming Techniques	Dec 1	Jan 23	February 1/87

Advertisers and Authors should have material submitted no later than the 'Copy Due' date to be included with the respective issue.

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- Structured Programming With COMAL, $26.95
- Foundations With COMAL, $19.95
- Cartridge Graphics and Sound, $9.95
- Captain COMAL Gets Organized, $19.95
- Graphics Primer, $19.95
- COMAL 2.0 Packages, $19.95
- Library of Functions and Procedures, $19.95

OTHER:
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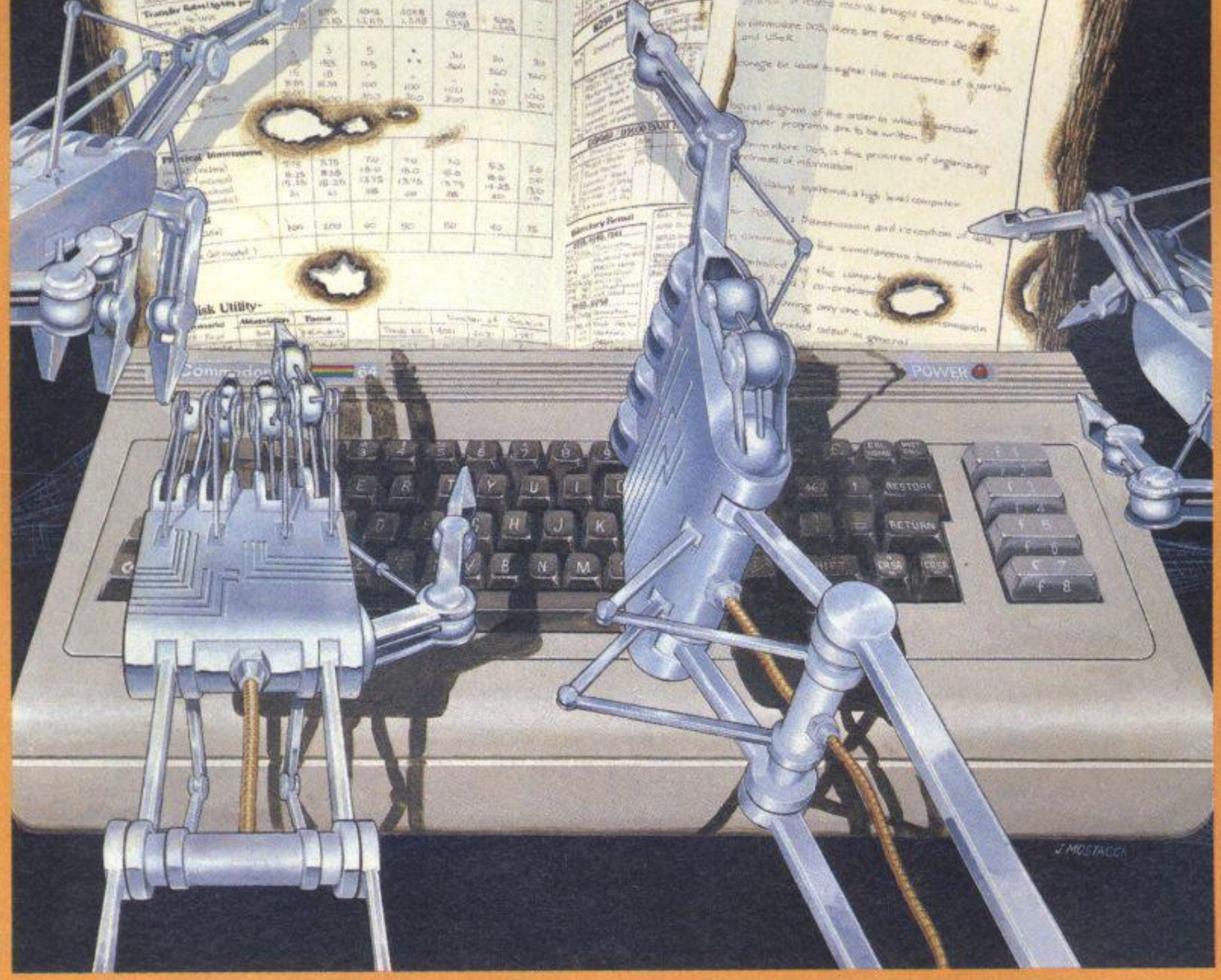

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